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Vol. 5 No. 50 (New Series) FEBRUARY, 1959

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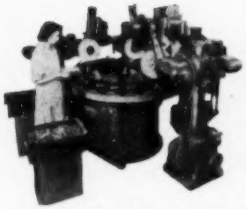

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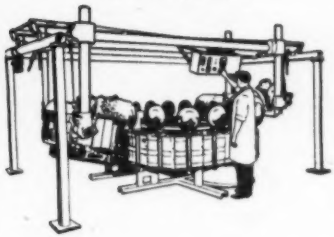
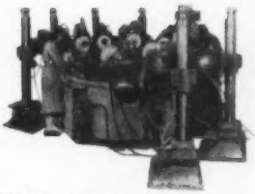
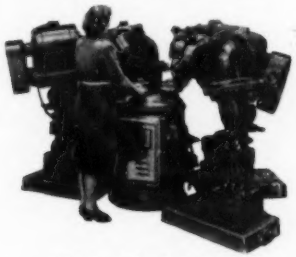




72" diam. M/c. (Indexing type).



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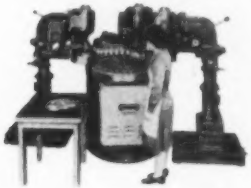

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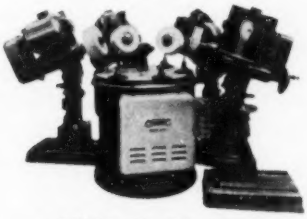
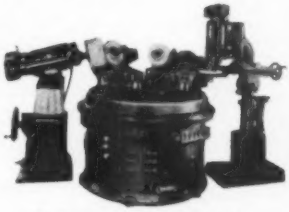


30" diam M/c. (Indexing type).



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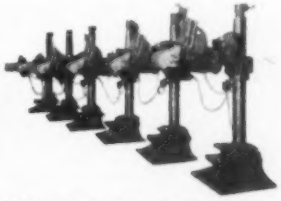

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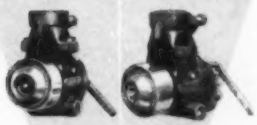

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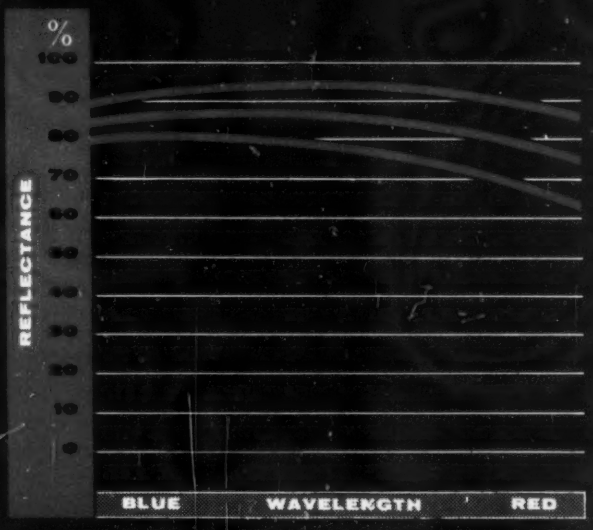

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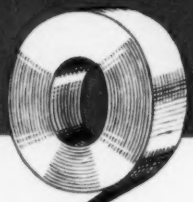

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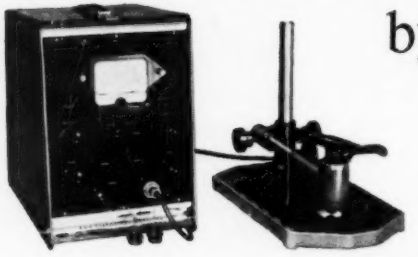

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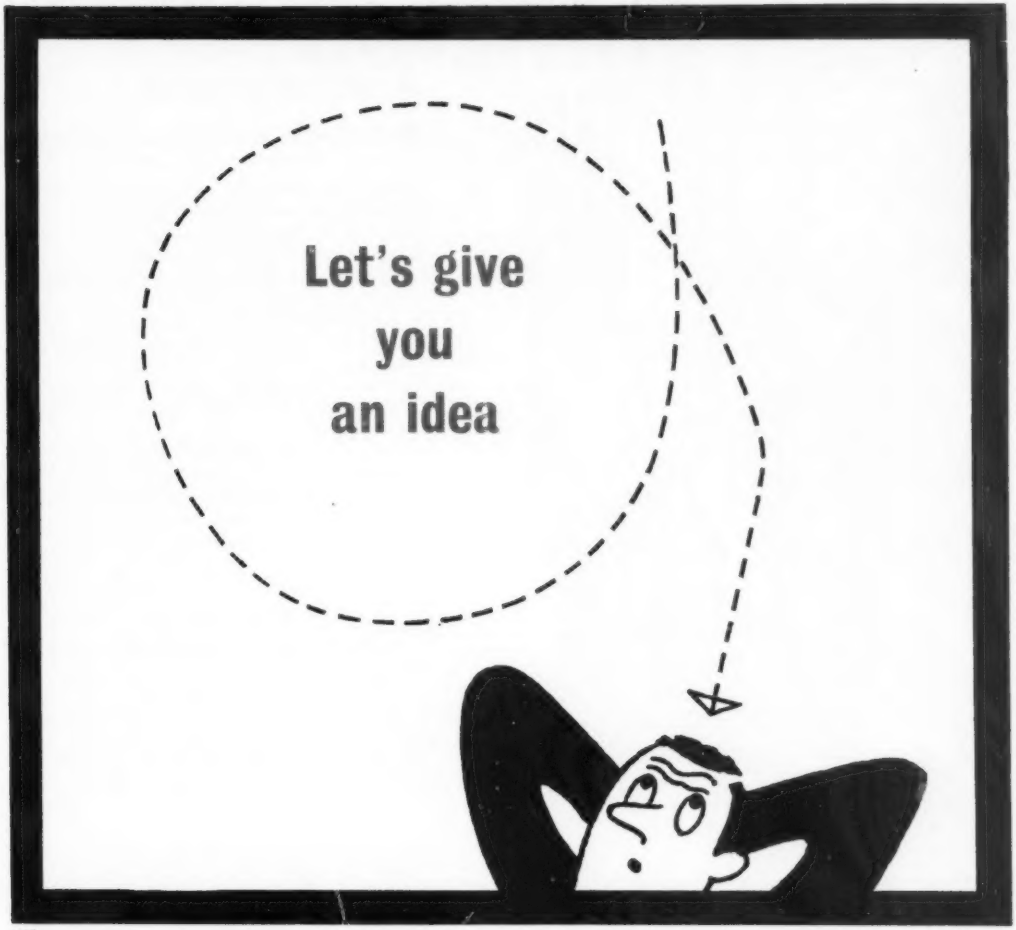

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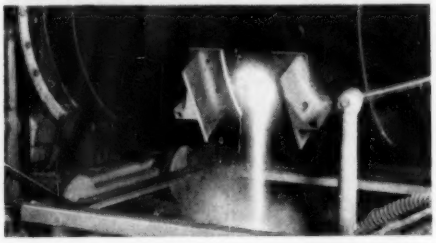

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THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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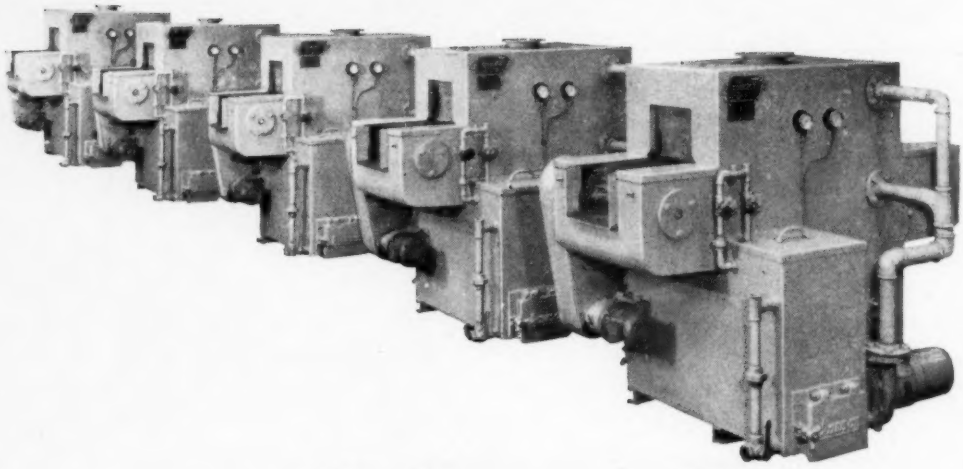
Metal Cleaning for Mass Production . . .



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BACK TO NATURE

NATURE study, or more particularly, the study of things reverting to their natural conditions is attracting ever increasing interest at the present time. In the case of the reversion of young ladies in a Burlesque show to a natural condition the principal students seem to be drawn from tired middle-aged business men, but further examination of the methods and motives of this class of student, fascinating though it might be, cannot really be claimed to fall within our terms of reference.

On the other hand the innate tendency of most of the common metallic materials of construction to return to the natural condition from which they were wrenched by the complex thermochemical processes of extraction metallurgy, is highly pertinent and, from the industrial point of view, far more rewarding.

Those responsible for the study of this relapsing property of metals — corrosionists or corrosion engineers as they are now coming to be called — have lent something of a romantic aura to their particular branch of science by presenting it in the guise of an unremitting struggle with an omnipresent and hostile force against whose ravages the only defence is unremitting vigilance and superior strategy. It is true that this concept, as might be expected, emanated originally from the traditional lands of romantic adventure across the Channel where a devoted band is gathered round the standard waging " la lutte contre la corrosion a l'outrance, " but they have not been left to struggle alone and a second front has been most effectively launched in the last few years with its operational headquarters in some of the best known centres of learning and research in this country.

To those without specialist knowledge of the subject it might appear strange that so apparently simple and everyday a phenomenon as the rusting of a steel surface should present the need for such detailed and exhaustive scientific study, and should indeed have retained some aspects of its behaviour which even yet are imperfectly understood. Nevertheless, such is the case and some measure of the amount of scientific endeavour which is now being brought into play in support of the front line troops could be gleaned from the number and scope of the exhibits (reported on elsewhere in this issue) which were displayed during the increasingly popular conversazione and exhibition staged annually by the Corrosion Group of the Society of Chemical Industry.

If one can draw a parallel between the study of corrosion and the study of human disease, which is on the face of it not an absurd comparison, it becomes evident that as in medicine it is necessary to know something of the cause of a disease before being able to prescribe a cure, so in corrosion a knowledge of fundamental causes is a necessary prerequisite to prevention. In the light of the results obtained from the most recent work it is becoming apparent that certain of the cherished traditional beliefs relating to the method of operation of established corrosion preventive measures will need to undergo drastic revision, and in the same way that the tank and the atom bomb have revolutionized man's methods of warring against his fellows, the results of modern research may well provide such weapons as will give a new look to the age-old struggle to prevent hard-won metals implementing their affinity for their environment.

Talking Points

by " PLATELAYER "

TOPICAL COMMENT FROM THE MAIN LINES AND SIDE LINES OF METAL FINISHING

SLOW MOTION

IN the past few years there has been a quiet, but almost complete revolution in previous ideas on how nickel-chromium fails in service. At one time nickel was regarded as an almost permanent protective plate which only allowed corrosion of the basis metal to occur because it was porous, and that if a non-porous nickel deposit could be produced commercially all our problems would be solved. Also, the chromium layer it was thought, simply served as a tarnish-resisting film which had little or no effect on the protection afforded by the combined deposit, this depending almost entirely on the nickel.

Now much of this has changed ; it is known that nickel itself will corrode and lead to failure of the plate, whether it is porous or not, and that the chromium deposit plays a very important part in the life of the article. Chromium can greatly accelerate or retard the corrosion of the underlying nickel, depending on a variety of conditions which are now becoming understood.

As a consequence of this new knowledge, it has been fully established that by quite a number of methods, such as depositing the chromium under slightly different conditions, or interposing chromium between two layers of nickel, the durability of nickel-chromium plating can be increased three-fold or more with the same total nickel thickness. The effect of these findings on ordinary commercial practice has been almost nil, so far, but no doubt the time will come when the industry will sit up and take notice.

GOOD BUSINESS

A FINE new source of business for anodizers in the U.S.A. is likely to develop as a result of the adoption by the State of South Carolina of anodized aluminium driving licences. The plates are produced by photographing the relevant parts of the application forms on to a sensitized aluminium plate, thirty-six at a time from a single negative, developing and anodizing the resulting sheet in the standard manner which has been used in the production of name-plates etc., for many years. This gives a light and permanent driving licence.

With the introduction in this country of the new three-year driving licence, it may well be found that some licences at any rate may become dirty or illegible in time and this is a way of overcoming the problem. There is, however, one great obstacle to its adoption here—there is no means of providing for endorsements on the anodized plate !

The new scheme offers a further outlet for aluminium in the motor car licence field in the U.S.A. Already, there is an enormous production of number plates since every American car has to have a new number plate each year—and there are more cars in America than there are people in the United Kingdom.

ANTI-SUNBURN FOR PAINTS

SOME years ago under the above heading a suggestion was made in this column that some of the materials which have the property of absorbing ultra-violet lights might usefully be employed in paints or lacquers to improve their resistance to out-door exposure. At that time although there were quite a considerable number of such substances available, little work had been done on the possibility of employing them for this purpose.

It is interesting to see that the American Cyanamide Company is now offering a material which, it is claimed, will effectively improve the life of paints and varnishes in just this way. It appears that the product is primarily designed for use in plastics but it will behave similarly in finishes.

It will be interesting to see how the use of these materials in the industry develop in practice, because if the claims made for them are justified the market should be substantial.

UNCONSCIOUS HUMOUR

ADVERTISING copy is usually most carefully written, and is checked and re-checked. Therefore, when a joke or a pun appears one tends to assume that it is deliberate. There are, however, two recent advertisements where one can justifiably have one's doubts. The first is an American one extolling the " magnetic appeal of stainless steel " for automobile trim. Here, one might perhaps assume that the copy-writer was not aware of the technical fact that austenitic stainless steel is non-magnetic.

The other advertisement is by a British firm which describes itself as " the sole manufacturer of aluminium heels." This is most likely an inadvertent pun, incredible as it may seem ; surely no advertising copy-writer would deliberately descend to such depths !

COSTING
in the Metal-Finishing Industry*

by S. TURNER†

IT is probably true to say that in the majority of small plating businesses in this country very little costing is practised beyond the prime cost stage. Therefore the subject of this paper does not imply merely a discussion of the finer points of costing or the variations of practice within the metal-finishing industry. It calls for a much more explicit review of those techniques which may be applied to the industry and the means by which they may be achieved. Readers may be also interested to read earlier papers on this subject ([1, 2, 3]).

Cost Information as an Aid to Management

In all branches of industry today management calls for far more than a general idea of total costs to guide it in price fixing and in control of expenditure, and metal finishing can be no exception. The proportion of different types of expense making up a particular cost will indicate how far prices may be cut to meet competition before an order gained will adversely affect the total profit of the business, and details of cost make-up will also show where inefficiencies may be occurring and in which direction worth-while savings may be attempted. In short, a means is provided of sorting profitable orders from borderline jobs or even "losers", and of indicating where costs may be cut and which of the "losers" will thereby become profitable and to what extent. Only in a sellers' market can a firm remain in business with little knowledge of costs and hope to make up on the roundabouts what is lost on the swings. Usually astute buyers send plenty of orders for work under-priced but place elsewhere that work which is quoted too high. The immediate use of costs for estimating purposes then is extremely valuable, but, over and above that, cost information properly prepared and presented will provide to management information in regard to utilization of plant, labour efficiencies, the calculation of break-even points, general control of expenditure, and fulfil many other important functions referred to in more detail later.

The Method in Outline

Costing is merely applied commonsense but there have been evolved (as a result of a great deal of logical thinking and practical experience) very many basic rules which may be accepted and used according to particular circumstances. These rules and techniques have been collated so that whole sections or single rules may be applied as required and a system of costing built up to suit particular factories and types of industry, bearing in mind always that the system must fit the business and on no account should production procedure be hampered to facilitate costing.

The metal-finishing industry is made up very largely of many small plating and polishing units and the cost of costing will therefore rank for high consideration and whenever upwards of about 95 per cent accuracy can be achieved easily it would usually be better to accept that which is readily available rather than spend a lot of time and money trying to achieve accuracy to the last penny in the pound.

The procedure follows the general lines adopted in tackling many other complex problems. Total expenditure is broken down to its logical elements and then the proportion of each element is collected to provide totals of the cost incurred on each job.

Very simply, cost is made up of :

Direct Expenses

- Direct Labour
- Direct Materials
- Chargeable Expenses

→ Direct (or Prime) Cost

Indirect Expenses

- Variable Works Charges
- Fixed Works Charges

→ Works Cost or Cost of Production

- Transport and Despatch
- Selling Expenses
- Office and Administrative Expenses

→ Total Cost

*This article is based on a lecture, which was one of a series on "Recent Developments in Metal Finishing" held at the Borough Polytechnic, London.

†Ionic Plating Co. Ltd.

These elements can now be considered in more detail and the kind of expenses covered by each element shown.

(1) *DIRECT LABOUR*
All labour which may be charged directly to a particular job or process.

(2) *DIRECT MATERIALS*
Anodes, metal salts and brighteners, the consumption of which may be calculated for each job or process.

(3) *CHARGEABLE EXPENSES*
Invoiced expenses incurred specifically for a particular job or process, *e.g.* outwork polishing special jigs or equipment not suitable for general use.

(4) *INDIRECT WORKS EXPENSE*

(a) *Variable and Semi-variable Items*
General Labourers, Inspection, Maintenance, etc.
Holiday Wages.
National Insurance.
Indirect Materials, *e.g.* polishing mops, hand tools, wire, protective clothing, chemicals, etc.
Process Steam, Gas, Electricity and Water.
Effluent Disposal.
Repairs and maintenance of plant.
Repairs and maintenance of jigs in general use.

(b) *Fixed Items*
Salaries of Works Officials.
Repairs and maintenance of buildings.
Rent and Rates.
Depreciation of plant (and of buildings if owned).
Heating.
Cleaning.
Canteen.
Welfare.

(5) *TRANSPORT and DESPATCH*
Drivers' Wages.
Depreciation of vans and lorries.
Road Taxes and Driving Licences.
Salaries of Transport Controller and Despatch Personnel.

(6) *SELLING EXPENSES*
Salesmen and Sales Office salaries and expenses.
Advertising.
Exhibitions.

(7) *OFFICE AND ADMINISTRATION EXPENSES.*
Salaries of Office and Administrative Personnel.
Stationery.
Telephones.
Postage.
Audit Fees.
Bank Charges.
Bad Debts.
Office Appliances.

Allocation of Works Expense

Any set of accounts will provide or may be arranged to provide the totals of expenditure under these headings and our next step is to break down each item of works expenditure to show the amount incurred by each production department and works service section. This may be carried out in the following manner :—

Direct Labour

Each department is charged with the gross wages of the people engaged on direct production or a proportion of a man's wages where he works in more than one shop.

Direct Materials

One basic essential to the proper operation of any costing system (and to effective control) is the maintenance of a material stores to which all purchases are delivered and from which goods are issued against properly authorized material requisitions which indicate the section of the factory to which the issue is made.

Actual issues to each section of anodes, metal salts and brighteners are evaluated and the totals recorded for each week or month.

Chargeable Expenses

Invoices received from outside suppliers are charged directly to the department and job concerned.

Indirect Labour ; Holiday Wages, etc.

Charged to each department or service section according to the duties performed.

Indirect Materials

Actual issues to each section in the period are evaluated and recorded.

Process Steam, Gas, Electricity and Water and Effluent Disposal

Consumptions metered in total may be re-metered to departments but, as this is somewhat expensive, it is more usual to divide the cost of each service on the basis of technical estimates relative to the volume of work passing through each shop. Where necessary, however, portable meters may be inserted into a circuit to check the actual consumption in a particular shop. Cost of effluent disposal may be regarded as proportionate to water consumed except where particularly heavy concentrations involving a price penalty arise from certain sections.

Repairs and Maintenance

Labour from time-sheet bookings and materials from stores requisitions or invoices are recorded to the service section and subsequently transferred to the department for which the repair was carried out.

Works Fixed Expenses

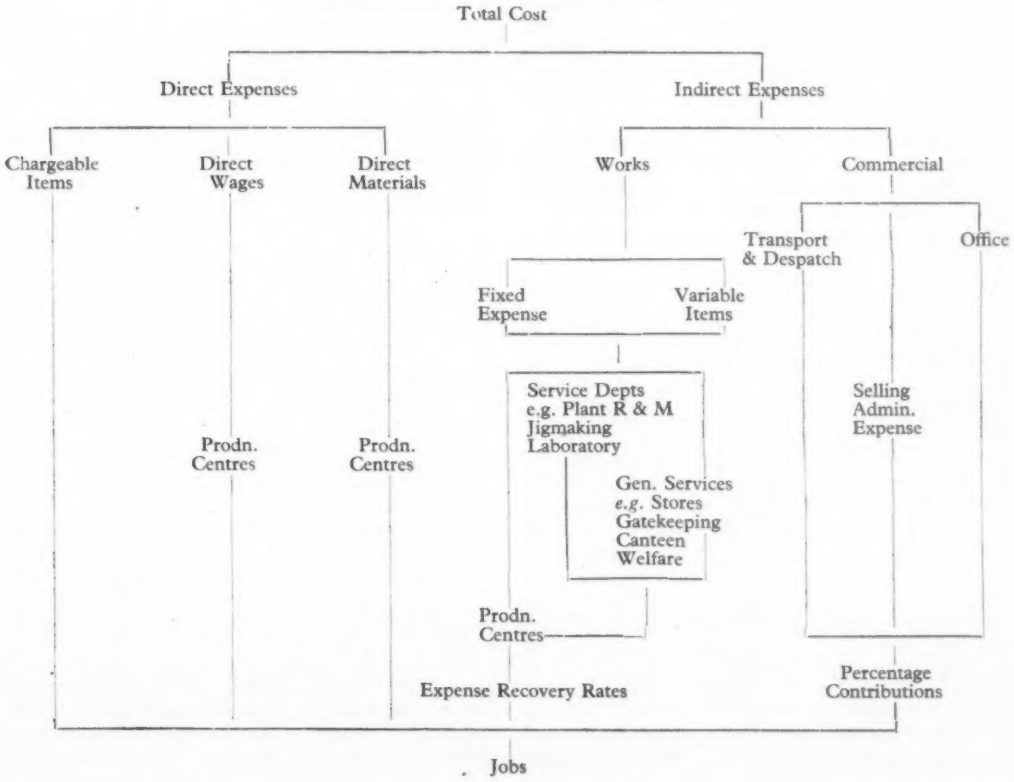
The depreciation incurred on plant in each department is so charged. Repairs and maintenance of buildings, rent, rates, heating and general cleaning may be charged to each section of the factory according to the floor area occupied. Salaries of foremen are charged to the departments supervised and general works management, welfare and canteen expenses may be allotted on the basis of the total number of employees in each section.

Cost Centres

Before going any further it is necessary to discuss the boundaries of production departments and service sections as determined for costing purposes. To deal with the simpler group first, service sections are merely the maintenance shop, jigmaker's bench, laboratory, inspection department stores, warehouse, etc. The production cost centres are not necessarily areas bounded by walls and in fact many cost centres may be contained in one shop and one cost centre may be located in two or more shops. Cost centres are determined according to the degree of variation between processes and their indirect cost and, where it is convenient, two or more similar processes may be combined into one cost centre so long as the indirect cost is similar when measured on a common basis. For instance. the hourly cost of barrelling in inclined barrels of one size is the same irrespective of whether zinc, tin, cadmium, copper or nickel is being deposited. The only differences are the cost of the anode metal and the time taken to achieve the requisite deposit. But because the indirect cost per hour is the same, all finishes may be regarded as one cost centre. The same thing applies with horizontal barrels, but because loads and times and costs are different as between inclined and horizontal barrels, there must be at least two cost centres for these and chrome barrelling would need to be another separate centre. Other centres which might be necessary include :

Base Polishing
Nickel Finishing
Wiring
Jigging

Breakdown of Total Expenditure to Job Costs



General Hand Plating, Auto Vat Plating, H.D. Plating, Precious Metal Section } sub-divided into finishes or groups of finishes as needed
Phosphating
Anodizing

So far the total expenditure has been considered and accounts have indicated how much of this is in respect of special purchases for particular jobs (chargeable items,) how much for wages and materials and how much for the numerous items of fixed and variable expenses.

The direct wages and materials have been separated from indirect wages and materials and the whole of the works expense has been allocated in detail to cost centres, (*i.e.* production centres or services), so that the make-up of expenditure in each is known.

Later it will be necessary to route the expenditure on services to the production centres and then the cost incurred in each production centre to the jobs performed therein.

Cost Recovery

The inclusion of the proper proportion of each element of cost in an estimate upon which the selling price may be based results in the recovery from the customer of the expenditure incurred in carrying out the work together with a proportion of the fixed costs and (it is hoped) a margin of profit.

It is now much more possible to assess what is the proper proportion of each cost element that should be included in the estimate and perhaps we might well talk about the methods adopted to achieve fairly accurate and reliable costs of particular jobs.

Direct Labour

The direct labour cost of each process carried out on any article may be found from the piecework price or time allowed for the job where an incentive scheme is used or from records of time spent on each job by workpeople paid a fixed hourly or weekly wage. Every effort should be made to charge wages directly where possible. If, for instance, exceptionally heavy or bulky work is offered which will call for the employment of extra people to unload the articles, transport them around the works and back to the lorry deck for despatch, it would be quite reasonable to include their wages as a direct charge against this particular job. In fact it would be unfair to class this item as indirect labour to be recovered on all work going through the shop.

Direct Materials

Metal deposited comes from anodes and metal salts and the weight of a given thickness on one square foot of surface area may be calculated for each metal. Knowing the weight of metal deposited, a percentage uplift must be applied to allow for metal losses arising from overplating drag-out, filtration, plating on to jigs, wires or frames, re-plating rejects and for scrap anode stubs. From this the theoretical usage of anode metal may be checked in total against actual issues to each cost centre. (*N.B.* Weight of metal issued equals actual weight of anodes plus that proportion of the salts which represents metal). Brighteners where used are often quite expensive and since their consumption is relative to the metal deposited the cost may be equitably recovered by an addition to the deposit cost. Cleaner chemicals on the other hand are really more closely related to the surface area treated and thickness of deposit has no bearing on this item of expense. Theoretically therefore the cost should be recovered as a fixed charge per standard jig or barrel-load, but where all types of work receive approximately the same deposit the cost of cleaner chemicals may be recovered either as a percentage addition to the deposit cost or on direct labour to which it bears some relationship.

Chargeable Expenses

The cost of outside processes or special jigs or equipment will be obtained at the time of quoting and included as a separate item in the estimate.

Works Variable Expense

Many items of this nature tend to vary with the volume of production but not in strict relationship. Therefore it is necessary to obtain figures of expenditure in each department over a fairly long period before attempting to fix rates of recovery. Tentative rates may be fixed from records over about six months and these rates would be subject to revision during the ensuing year. After this initial period it is not necessary (in fact it is undesirable) to make any alteration to a rate except where it is shown to be in error over a long period, or where some specific cause of variance arises.

Service Departments and Services

Before assessing the total variable expense incurred by each production centre it is first necessary to transfer to them their due proportion of the cost of service departments and general services. The bases for these transfers of cost may vary in particular cases but the following will provide some useful general guide for the plating industry.

Expense	*Basis of Apportionment*
Stores, Premises, Personnel and Equipment.	Value or tonnage of materials issued to each cost centre.

Plant Maintenance Department	Cost of work carried out as recorded on time sheets and material requisitions.
Jig Maintenance	ditto
Inspectors	ditto
Laboratory	Services rendered.
General Services	Total employees (direct and indirect) in each shop.

All works indirect costs have now been routed to the production centres and it is possible to consider the recovery of these expenses by means of overhead recovery rates.

Recovery Rates

What are these recovery rates and how are they obtained ? It will be realized that there will be a different rate for each production centre and the rates may be applied on different bases according to the particular circumstances pertaining in each department.

In the polishing shops no recovery has been made, so far, other than for direct labour (polishers' wages). It is found that during the past six months a certain amount of money has been spent on shop labourers, inspectors, bobs, mops, compos, electric current, repairs and maintenance of plant and so on ; also known is how much has been paid in direct wages during the same period and it is possible to express the shop variable indirect expense as a percentage of direct wages separately for the base polishing and for the nickel finishing sections. If these percentages are applied to the respective direct labour costs in the estimates, the due proportion of the variable indirect costs will be recovered. If a record of the direct labour hours is available it would be rather more accurate to recover indirect expense at so much per hour worked on the job. The above procedure applies to hand polishing only, and is adopted because most of the variable indirect expense may be related to the efforts of the average direct worker.

Similar procedures may be adopted for wiring and jigging but rather different techniques are needed when dealing with the plating shops. Here men are handling work in and out of cleaners, swills, plating tanks or barrels, drag-out tanks, etc. and the procedure is similar irrespective of the time of plating. In paying the men, some regard must be given to the absorption of plant capacity by work occupying longer plating times but this only makes direct labour or wages even less suitable for use as a basis for the recovery of all indirect expense. Those items of expense that relate to labour (*e.g.* holiday wages, national insurance, protective clothing) may be recovered on a direct labour basis as previously mentioned, but those items which relate to plant (*e.g.* repairs and maintenance, gas, water, steam, electricity) must be reduced to a rate per effective plant-hour. For example it is known that a particular vat, barrel or group of vats or barrels are operated for, say, 50 hours per week but from records it is found that operator rest periods, progressing difficulties, periodic shortages of work and time occupied replating rejects, etc., reduces the effective utilization to around 35 hours per week. By dividing the average weekly indirect variable expense on plant by, say, 35 (times the number of vats or barrels), a rate per vat or barrel hour will be obtained which will recover in the estimates the expenditure in this direction. But in vat plating it often happens that a load is made up of a number of different items and it is much more convenient to use a smaller standard of measurement. For this purpose a standard jig or frame carrying a specified surface area for plating may be assumed. By dividing the vat-hour rate by the number of standard jigs that can be accommodated in that vat, a standard jig-hour rate is obtained and, by relating the number of each article to the standard jig and to the required plating time, the amount of indirect variable expense applicable to each job may be calculated. There are three factors that limit the number of articles that may be accommodated on a jig. In addition to surface area, both weight and general geometry must receive due consideration.

The surface area of 1 lb. of barrel plating work can vary enormously according to the shape and character of the article and it is necessary to vary either the weight of load or time of plating to achieve equal deposit on different types of work. It is obviously quite impossible to attempt to assess the exact surface area per 1 lb. weight of every one of the varied items received for processing but it is essential from the technical angle to segregate work into main categories of high, medium, or low relationship of surface area to weight. Plating times or loads may then be varied to give the required deposit thickness taking into consideration both the metal being deposited and the weight/surface area relationship. Variable works expense may be calculated at the standard rate per barrel-hour for any load and time combination and the result divided by the load in lb. will give the variable works expense per lb. of any item and finish.

Works Fixed Expenses

It is sometimes suggested that costing and estimating may safely be left at the variable stage and all work made to carry some proportion of the Works Fixed and General Commercial Charges. This is quite logical in some industries but in plating where some processes call for technical control to a large degree and others for little or nothing, and where expensive automatics are used

in some sections and relatively cheap hand-operated equipment in others, such a system would mean that all sections would be carrying the cost of technical control equally and automatics, which usually show a saving in direct labour, would be expected to cover only a portion of their heavy depreciation charge, the balance being an overburden on the hand-operated processes.

It is therefore better to allocate works fixed charges to the cost centres on the most equitable bases as previously suggested, and to add the rates obtained for each cost centre in respect of works fixed charges to those previously obtained for works variable expenses and so provide a single works overhead rate for each cost centre (or two rates where both labour and plant hour bases are necessary).

Commerical Expenses
(Selling, Distribution, Office and General Administration.

Expenses under this head are segregated mainly for purposes of control to show first the cost under each sub-heading and then the type of expense incurred, *e.g.* salaries, postage, telephones, stationery, drivers' wages, upkeep of lorries and cars, advertising, exhibitions, etc. There is no true basis for recovering the majority of these items in a wide assortment of production costs. What equitable basis can there be for recovering sales expense when twenty calls may yeild nothing and one recommendation lead to good orders ; or for allocating general management and office charges where the duties involved bear no relation to the character or value of the saleable product ; where a customer's special requirement may involve the management in lengthy discussion disproportionate to the sales value but with quite unknown future possibilities ?

Delivery charges outside the normal local round of platers' vans should be covered separately in the price, but apart from expenses of this nature the whole of the charges in this category may well be regarded as expenditure to which all work must make some contribution under normal trading conditions.

Other Aids to Management Arising From Cost Information

This section has been marshalled so that items of most interest to platers are mentioned first leaving the subjects of more general interest to be dealt with later if time is available. With this in mind it is natural that my first observation should be in connection with rejects.

Rejects

A high rate of rejects is probably the most costly misadventure that can occur in a plating shop. Rectification absorbs cost in every direction and occupies time which should be utilized on new profit-earning work. Furthermore, the proportion of rejects arising from re-claimed work is often a good deal higher than that on new work. Much time and money is therefore spent on rejects and it is not uncommon for a number of these articles finally to be rendered useless, thereby impairing customer relations.

For these reasons it is of the utmost importance that control of rejects be rigidly maintained. The first essential is a record of the rejects arising from each section of the works together with an analysis of the reasons for rejection and quantities shown as percentages of the number passed. Where the volume of a particular item is large and in all cases where the reject percentage is high, the record should be compiled daily and issued early the following morning. This will enable special attention to be given to those sections incurring high reject rates and will show which source of rejection needs priority investigation. Where necessary the cost significance of rejects may be illustrated to some extent by a statement showing the sales value of plant capacity absorbed by reclamation work plus the cost of stripping, but this will not give a complete picture in that the disruption of progress and planning schedules and the effect on service to the customer cannot be measured in terms of £ s. d.

Metal Losses

Output measured in terms of standard jig hours or standard barrel hours for each finish will give an approximation of the amount of each kind of metal deposited on the cathode in each cost centre during a particular period. Issues of metal in the form of anodes and metal salts to each cost centre during the same period may be summarized and will show how much metal has been issued in excess of that deposited.

In the short term severe fluctuations may be evident due to the intermittent renewal of anodes, etc., but if the records are maintained progressively a good check will soon be provided against the percentage used in the estimates for losses of anode metal. Attention is directed to high losses of particular metals in particular sections thereby facilitating investigation and hastening the necessary preventive measures. If exceptional losses occur and no source of undue waste is found, the possibility of pilferage must be considered.

Indirect Materials and Other Variable Works Overheads

Losses or excess consumption of indirect materials or of other items of works expense may be controlled very largely by comparison with previous records. Detailed budgets are of course the best medium

of control but in a small business the gain or loss of a single order may considerably affect the total volume of work and thereby largely destroy the value of a budget based on normal activity. But the maintenance of detailed records of expenses incurred in each cost centre will provide a means of comparison which will often bring out variations, that would have passed un-noticed in the grand totals, and sources of waste will be revealed that might otherwise have been concealed by savings in other directions. Comparisons of this sort must allow for changes in the volume of output from each shop.

Plant Utilization

In the metal-finishing trade a surprising feature of cost is the amount of additional output that can be achieved for the expenditure of a relatively small amount of extra money. This does not apply so much to polishing and is due to the fact that plating involves a high depreciation rate on plant and installations as well as considerable technical control, a high cost of solutions and anodes and chemicals, and of water, steam, electricity, etc. Even where they should follow the volume of output, it is found in practice that many of these items of cost do not rise and fall in anything like due proportion and it is therefore important to maintain demand at the highest possible level in order to keep the plant working effectively and idle time to a minimum.

If outputs have been recorded in standard jig-hours or standard barrel-hours, it is possible from the known capacity in each section to calculate the effective utilizations. Reasons for under-utilization should be analysed (*e.g.* no work, absenteeism, chemical, mechanical, or electrical failure) and the percentages given for under-utilization arising from each cause.

Planning and Progress

Measurement of capacities and outputs in this way will be of assistance in plant loading and progress in that orders in the shop may be measured in jig-hours or barrel-hours and the approximate extent of plant loading and the time for completion of a particular job known. Furthermore, as soon as the load begins to fall in any section, the matter is apparent before that item of plant comes to a stop and efforts may be made either to obtain more orders for that type of work or maybe transfer similar work from other departments.

Effect on Cost of Varying Demand

Out-platers, unlike manufacturers, can do nothing to even out the variations of demand by working on stock orders and, as a consequence, violent short-term fluctuations are often experienced in additon to the general changes in the volume of trade that occur periodically. During times of reduced demand the indirect cost per jig-hour or barrel-hour will undoubtedly rise and it must be understood that this is an expense which must be carried by the Company since to increase prices in times of reduced demand would only add to the difficulty of obtaining further orders. It is therefore necessary to fix prices on the basis of normal activity and (except where influenced by other factors) to endeavour to maintain these prices through the variations in demand, building a reserve in time of high activity to counterbalance the loss of profits in periods of slackness.

Limit of Price-Cutting

When trade is very bad competition invariably becomes much more keen and it may be necessary to cut prices in order to remain in business. How far may this price-cutting be carried ? As a temporary measure in extremely difficult times a price may cover only the additional cost incurred to do the work with some little contribution to the fixed expense. This means that the price could be based on the cost of the direct elements plus works variable expense and distribution only. Any addition to this part of cost would be a contribution to fixed expense and would mean that the overall loss resulting in the period would be a little lower than if the order were not gained.

Break-Even Point

The effect on the Profit and Loss account of the Fixed and Semi-Variable expenses is most important and, provided that a reasonably accurate estimate is made of the semi-variables, it is possible to forecast at what rate of turnover and at what level of prices the income will just equal the expenditure. This is known as the break-even point.

Direction of Sales Effort

A feature of business in general is that when demand falls more time and money tends to be spent on selling, advertising, exhibitions, etc. Thus the fixed burden tends to increase in this direction at a time when the spread is diminished, and it is a great advantage to have information on which types of work, finishes, deposits, etc., are likely to prove the most remunerative so that sales drives may be directed with a view to obtaining the most satisfactory results from the restricted market.

Effect of Restricting or Expanding Plant Capacity

In a trade depression of long duration a time may arrive when consideration must be given to the question whether or not to continue the activities of a particular section. It is then necessary to know what income may be lost, what saving of variable cost will be effected and to what extent

(*Continued in page* 70)

A Quarterly Survey of some of the Features in Finishing Literature from Abroad

by **SCRUTATOR**

Alkaline Descaling Cleaners

ALTHOUGH not new, alkaline descaling cleaners are gaining some popularity in the plating and metal-finishing industries. They can be used either with or without applied electric current for the removal of rust, heat-treatment scale, smut, oxides, stains and many paints from iron and steel. Due to their alkalinity no dissolution of the basis metal takes place so that tolerances of finished machined parts remain unaltered. Further when simple immersion or reverse current is used, hydrogen embrittlement does not occur. The Lycoming Division of AVCO Manufacturing Corporation have successfully used these versatile materials for several years and six typical process applications have been described by Jorczyk[1].

Paints and Painting

Difficult as it may seem, still further methods of applying organic finishing materials, in particular paint, to metal and other surfaces have been developed. The two most recent are the hydraspray process[2] and the use of a ' pressure curtain '[3]. The former takes its name from the accomplishment of successful spraying by the release of high hydrostatic (or hydrodynamic) pressures. The pressures of 1000 to 2000 lb. per sq. in. are obtained from a reciprocating, double-acting air motor that is mechanically coupled by a connecting rod to a reciprocating double-acting pump. The pumping unit is capable of multiplying the paint pressure to approximately twenty times that of the air pressure admitted to the air motor through an adjustable regulator. At an air pressure of 50 to 80 lb. per sq. in., about 5 cubic feet per minute of air are required for each spray gun that is in constant operation and the paint is transferred by hose at high pressure and room temperature to the gun which feels and looks like a conventional spray gun except that it has no air connection. The elimination of bounce-back or overspray are two of the main advantages claimed for this technique. For the high-speed coating of suitable parts, the ' pressure curtain ' seems to have considerable potentialities — and a strong resemblance to flow coating. The principle of the method is that the stock to be coated is moved through a thin curtain of flowing material on flat conveyor belts. The process is most economical as the only loss of material is by solvent evaporation. Further, as the required film thickness is originally applied, there is no excess material to run off. Coating speeds of up to 400 ft. per minute are claimed and coating units from 12 to 75 in. width are available. The main components consist of a head (or heads) which release a curtain of the material, a belt (or belts) and a paint circulating system. A cast aluminium head traverses the width of the coater directly above a material collecting trough. The paint is pumped under pressure into this head against an entrapped air cushion which ensures that the material extruded from the orifice on the underside of the head is uniform across its entire width. This orifice consists of a stationary and a moveable knife which can be controlled to produce film thicknesses of 1 to 10 mil. using coating materials with viscosities varying from less than 20 to more than 200 seconds on a No. 4 Ford cup.

As regards paints themselves, brief details have been given by Marino[4] of a new range of water-soluble stoving paints. It is claimed that these can be composed of either a phenolic or melamine mixture although only those containing phenolic binders are at present on the market. Stoving temperature is about 325° F., colours are at present limited to darker shades although most pigments may be used except those such as zinc oxide or chromate which have an alkaline reaction ; and they can be supplied by spraying, dipping or roller coating.

Mechanical Finishing

Barrel finishing or tumbling is a ' traditional ' technique, which in spite of its well-known and accepted limitations, is widely employed. Two recent modifications of the method, which under certain conditions offer definite advantages, have recently been described. In the first of these, precision finishing, ten to two hundred times faster than barrel tumbling, is achieved by a controlled 3-way vibration of a single container loaded with components and finishing media[5]. The container is a spring-mounted open bowl to which a motor driven eccentric shaft transmits

(*Continued in page* 58)

Some Notes on

Currently Available Processes for PICKLING TITANIUM and its ALLOYS

TITANIUM might now be said to be leaving its adolescent years and approaching maturity. The metal which needed 115 years from its first crude isolation before a commercially practical way of extracting it was evolved—by Kroll in 1940—is now being absorbed by the engineering industries at a rate of many tons per week, notwithstanding a billet price of over £3 a pound. The interest in titanium mainly centres on its low density, relatively high tensile strength, exceptional mechanical properties when alloyed and excellent corrosion resistance.

From the standpoint of surface treatment and finishing the metal has two cardinal characteristics. The first is that like aluminium it is an extremely reactive metal, but ordinarily it is passivated by a thin oxide film which at low temperatures confers the high corrosion resistance. The other is its proclivity for absorbing small amounts of oxygen and nitrogen which embrittles the metal and completely vitiates its mechanical attributes. Both of these characteristics, which cause the metallurgist so much concern during extraction and fabrication, likewise tax the ingenuity of the man who would attempt to apply a finish or surface treatment. This article briefly reviews the practice of finishing titanium and high-titanium alloys, the chief ones of which are the 2 per cent Al - 2 per cent Mn, the 4 per cent Al-4 per cent Mn, the 5 per cent Al-2½ per cent Sn and the 6 per cent Al-4 per cent V alloys.

The corrosion resistance of the commercially pure metal is often higher than austenitic stainless, and only one reagent is truly inimical, fuming nitric acid. This can, incidentally cause a vigorous pyrophoric action to take place. The metal is resistant to boiling 10 per cent caustic soda, and to organic solvent vapours, and may therefore be degreased by any of the conventional alkali, solvent or emulsion cleaners. Pickling, however, is another matter. The difficulties inherent in pickling titanium are not only due to the corrosion resistance of the metal and its scale, however. With many otherwise satisfactory pickles there is a grave danger of hydrogen pick-up which, particularly in thin sections can ruin the product. Then, too, the loss of metal with many pickles is high—a very important matter with this metal.

Pickling is required both as an interstage process to avoid oxide being worked into sound metal and, since the scale is a hard one, to faciliate machining ; it is usually an essential preliminary to any other surface treatment, too. The scale on wrought products due to heating in air consists of a brittle skin of mixed oxides and nitrides, removable only by quite drastic treatments.

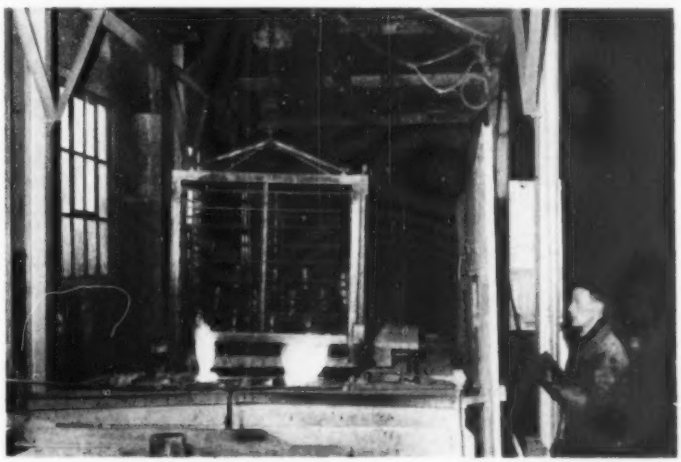


Fig. 1.—Contract sodium-hydride descaling of titanium-alloy components. The flames are of burning hydrogen gas after it has bubbled through the molten sodium.

(Courtesy, D. & H. Metal Treatments Ltd.)

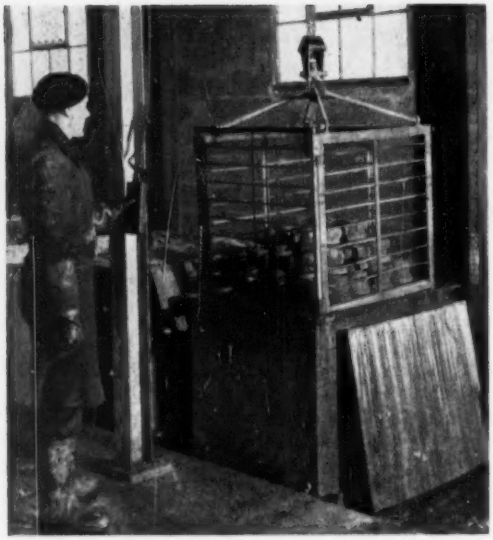


Fig. 2.—Titanium-alloy components after sodium-hydride descaling.
(Courtesy, D. & H. Metal Treatments Ltd.)

Blast treatments may be used, iron, silicon carbide and alumina grits all proving suitable. Since they tend to become embedded, however, an appropriate acid pickle is to be recommended afterwards ; two are 4 per cent HF, and 4 per cent NaF plus 20 per cent nitric acid, each at 50°C.

Modified caustic-soda melts offer the fastest and most satisfactory removal technique for all thicknesses of scale. Of these there are several in general use, the most important being the sodium hydride, the Virgo and the Kolene No. 4 processes. Caustic soda alone, although a rapid descaler at high temperatures, markedly embrittles titanium when used above 540°C. while there is also a risk of an explosive reaction between melt and metal. Even above 450°C. there is a danger of embrittlement, while at lower temperatures although embrittlement is very slight the process becomes inordinately slow ; at 370°C, for instance, it may need 80 minutes, and the loss of metal is quite high.

Sodium Hydride Process

The basis of this process is a bath of caustic soda at 370°C. in which the very active reducing agent sodium hydride (2 per cent) is continuously being produced. This is achieved by arranging provision for a quantity of metallic sodium to be retained in the melt in a steel container. Through the sodium, which is molten at the bath temperature, is bubbled hydrogen gas, and the sodium hydride formed disperses throughout the melt. The plant needed includes a pre-heating oven to raise the work to 360°C., which avoids cooling the melt, dries the work, and burns off organic matter which may otherwise react with hot caustic soda. The melt is retained in a lagged, heavy-gauge mild-steel plate tank, heated by gas, immersion heaters or immersed electrodes. A catalytic generator is used to produce the hydrogen gas *in situ* from ammonia.

A technique suitable for titanium as thin as 0.015 in. is to treat it in the melt for 15 minutes, remove and quench it in cold water ; the steam formed blasts away most of the loosely adherent reduced scale. The metal is then lightly acid pickled by immersion in 8 per cent H_2SO_4 at 50°C. for about 1 minute, and after swilling, in 6 per cent HNO_3 plus 1 per cent HF at room temperature for 30 seconds. This serves to remove discolouration and brighten the metal, while the combined treatments give rise to no embrittlement and negligible loss of metal.

Virgo Process

This is again based on caustic soda, the active ingredients being some 15 per cent of oxidizing agents. The melt can be used on titanium at up to 540°C. without embrittlement or appreciable dissolution of metal. A typical sequence for heavily scaled parts, (above 0.0002 in, formed above 700°C.), is to immerse the dry work for 20 to 30 minutes at 500°C. followed by quenching and acid dip such as the one which follows the sodium-hydride treatment. Alternative dips include 10 : 2 : 5, nitric : hydrofluoric acid : water mixture at 60 to 70°C. for 2 or 3 minutes, and cold concentrated HF for ½ to 1 minute. For scales formed below 700°C. immersion at 425°C. for 5 to 20 minutes, followed by one of the acid dips, should be adequate.

The plant involved is essentially similar to that for the sodium-hydride process, although the pre-heat oven is not essential since organic matter does not react with the melt. Temperature control needs to be close, particularly when exceeding the nominal operating temperature of 500°C., since above 540°C. titanium is liable to react violently with it. The action of the melt is to dissolve and not merely reduce the oxides, while the oxidizing agents give two other advantages over the hydride process ; one is that they are rejuvenated by atmospheric oxygen unless very heavily worked, when it helps to bubble oxygen through the melt ; the other is that the process is less critical in respect of operating conditions for titanium.

Kolene No. 4 Process

This is also basically a caustic-soda melt used with or without applied current but containing

salts, which particularly when activated electrolytically, catalyze the descaling reactions. The steel tank acts as one electrode for a 6- or 8-volt d.c. heavy current supply, the other being the work crate. Normally descaling will be performed cathodically, and up to 30 minutes treatment, at 425 to 540°C. induces no embrittlement or loss of metal. The temperature must not exceed the higher figure owing to explosion hazards, but if the process is used electrolytically can often be greatly reduced. Non-electrolytic descaling may need 30 instead of 10 minutes at 500°C. Of additional interest, however, this process can be used anodically prior to descaling for the rapid removal of oil and grease.

Electrolytic Sodium Nitrite Process

A fourth molten salt process deserves mention, although not widely used. It is the electrolytic sodium nitrite melt, which can be used anodically at about 300 amp. per sq. ft. for 3 to 5 minutes on titanium with little metal loss. The disadvantages lie in the solution cost and short solution life, in the heavy d.c. power requirements, and in the toxic fumes released at the anode. Both this and the Kolene No. 4 process need to be followed by quenching and bright dipping.

A cautionary note on all molten-salt treatments applies to the processing of thin section work where the surface area per load is high. This work must be processed in small amounts and at the lowest practicable temperature, to avoid the heat of reaction locally raising the temperature to a dangerous level.

Acid Pickles

While molten salts offer the fastest and, properly controlled, the safest method of pickling titanium, the plant outlay is inevitably high and may not be justifiable. The plant involved in acid pickling can be much simpler even though the liquors used usually include hydrofluoric acid, and this is the recommended choice for light scales, *e.g.* those formed below 700°C. The risk of hydrogen embrittlement is still present, of course, particularly in those materials containing the β-phase, (*i.e.* heated above 882°C.). For such metal the pickle to use is the oxidizing one mentioned earlier comprising 20 per cent nitric acid plus 4 per cent of HF or sodium fluoride, used at 50°C. This does not significantly attack the metal but does appreciably brighten it ; used cold it gives a glossy gray finish. Where heavy scales are concerned, though, a preliminary blast or similar treatment is preferable to break up the scale.

Higher strengths of hydrofluoric acid up to 50 per cent (or conc.) have been used, often admixed with nitric acid. Typical is a solution of 8 per cent nitric : 2 per cent HF used at 60°C. ; the nitric acid content must be maintained if embrittlement is to be avoided. A recent investigation gives a preferred pickle for the avoidance of embrittlement which comprises 30 per cent nitric and 20 per cent hydrofluoric acids. A recommended light scale pickle sequence consists of immersion in 15 per cent H_2SO_4, cold, for 10 or 15 minutes, rinse, and a 1 to 3 minute dip in a mixture of 1 part HF, 3 parts nitric acid at 60° to

(*Continued in page* 58)

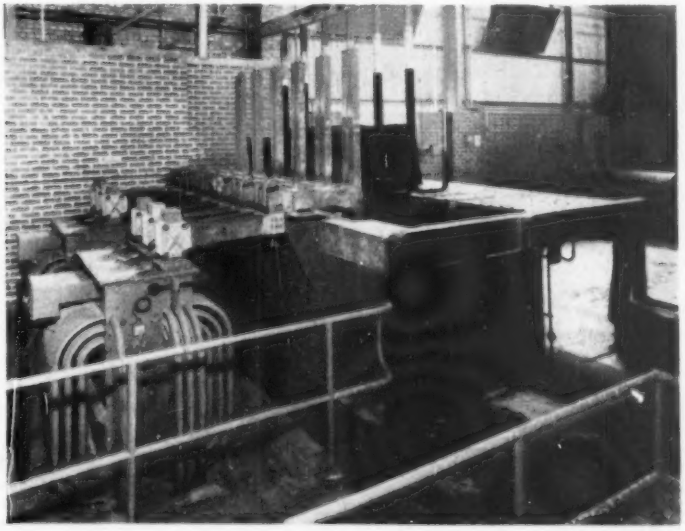


Fig. 3.—A VIRGO molten-salt descaling installation showing the heating electrodes and their power supply.

(Courtesy, Electric Furnace Co. Ltd).

Pickling Titanium and its Alloys

(*Continued from page 57*)

70°C. Fluoboric acid has also been tried and proves rapid in action since it penetrates the scale and attacks the metal thereby flaking the scale away. A 5 per cent solution, used at 85° to 90°C. needs only 10 minutes but the loss of metal may be 0.004 in. on even lightly scaled work. There is no embrittlement, however, while the attack on the metal is uniform. Other acid mixtures, but ones which also slightly etch the metal, include 3 per cent HCl plus 2 per cent HF at room temperature, and a mixture of :—

Nitric acid	450 cc.
Fluosilicic acid	100 cc.
Ammonium bifluoride	100 gm.
Sulphuric acid	450 cc.

Recently details have appeared of an electrolytic acid descaling treatment which has a very low rate of attack on the metal. This comprises a cathodic treatment in a solution of :—

Hydrofluoric acid	10 cc. per l.
Nitric acid	40 cc. per l.
Sulphuric acid	200 cc. per l.
Ferrous (or aluminium) sulphate	22.5 to 37.5 gm per l.

This used at room temperature (it warms up during use), at 6 to 36 volts d.c. with steel or titanium anodes. The time of treatment depends on the precise operating condition, but work incompletely descaled can be returned to the solution until a satisfactorily bright finish is obtained.

Some success has also attended attempts to evolve pretreatment etches to allow the metal to be electroplated, although the adhesion is not very high. One method is to anodically etch the parts in a hydrochloric acid solution, rinse, and strike copper plate in a Rochelle solution. Other deposits, although preferably not stressed ones, can then be applied. An etchant based on HF and ethylene glycol forms the basis of another anodic pretreatment, although the operating conditions are critical since the solution otherwise functions as an electropolishing one which gives non-adherent plates. This is strictly an anodizing process, deposition of most metals, including chromium being possible directly on to the oxide. The etch is used at room temperature and 50 amp. per sq. ft. for 10 to 20 minutes. Also of interest is a solution which deposits a titanium fluoride film from a hydrofluoracetic acid solution using a.c. ; this, too, can be used as pretreatment for direct chromium plating.

There is also a combined etch and strike solution for depositing a flash of zinc as undercoat for other metals. Used at room temperature, for 5 to 10 minutes, the solution comprises :—

Hydrofluoric acid	200 cc.
Zinc chloride	100 gm.
Ethylene glycol	800 cc.

This solution is used at a current density of about 10 amp per sq. ft., with a graphite anode.

Finally, it is of interest to mention a novel approach to the pickling of this rather fractious metal. This involves coating the metal with a carbonate nitrate mixture prior to annealing. This reacts to convert the oxides into a non-adherent titanate deposit, which can be displaced by a combination of mild mechanical action such as rubbing and a HNO_3 : HF pickle.

Overseas Review

(*Continued from page 54*)

the 3-way vibratory motion. Other benefits include the use of less media and compound. According to Castle[6] mechanical finishing using flowing abrasive media is particularly useful for large size parts — unlike barrel tumbling — and where high production is required and quality is of prime consideration. In this technique, the parts are loosely held in a rotating circular tub and the finishing is effected by immersing the fixtured metal parts in the moving, flowing abrasive for a prescribed time. Mechanical cleaning of a very different type has been described by Mueller[7] in a paper on the precision cleaning and deburring of missile guidance components. As the frictional torque requirements for the gyros could be exceeded if foreign particles smaller than 50 millionths of an inch accumulated in certain small clearance areas, it was necessary to remove ' burrs ' smaller than that which the unaided eye could see. The many techniques tried included the use of dental tools, pencil erasers, ink erasers, abrasive impregnated cord, glass fibre brushes, plastic sticks and lapping compound, etc. Hardly production line procedure !

Are Scientists People ?

The answer to this intriguing question has at last been established as a result of a survey carried out by the du Pont Company of a thousand of its technically trained people engaged in research[8]. What do you think ?

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(2) *Ind. Finishing*, (U.S.A.), 1958, **34**, (12), 58-62.
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(4) *Metal Finishing*, 1958, **56**, (11), 70-71.
(5) *Iron Age*, 1959, **183**, (3), 79-82.
(6) *Plating*, 1959, **46**, (1), 31-33.
(7) *Plating*, 1858, **45**, (9), 937-940.
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Society of Chemical Industry

CORROSION GROUP EXHIBITION

THE Corrosion Group of the Society of Chemical Industry staged an exhibition at the Battersea College of Science and Technology, Battersea Park Road, London, last month, running concurrently with the Society's *conversazione* held in the college by kind permission of the principal, Dr. R. W. West, O.B.E.,

The exhibition illustrated recent research and development that has been made into metallic corrosion and its prevention. A short description of some of the interesting examples on view is contained in the following pages. It will be seen that emphasis this year was placed on the apparatus and techniques of research and test.

Albright and Wilson (Mfg.) Ltd., 1 Knightsbridge Green, London, S.W.1.

Three displays on this stand related to the " Kanigen " process of producing nickel deposits by immersion of the work in a solution ; the " Phosbrite " processes for obtaining bright finishes ; and the use of " Calgonite " in water treatment.

The now well-known " Kanigen " system of chemical nickel plating can be used on most metals, and on glass, ceramics and thermo-setting resins. It is a nickel-phosphorous alloy containing about 8 per cent. phosphorous, and it can be applied even to articles of complicated shape. The plate obtained has a low porosity and therefore high corrosion resistance ; it is also hard and wear resistant, the deposited hardness being about 500 V.P.N., increasing to 1000 V.P.N. after heat treatment. Parts that had been plated by the process were displayed to illustate how the surface finish of the substrate material is reproduced, and how it can be used on titanium, steel and aluminium. Used as a plating on titanium, the process greatly enhances the wear resistance of the material, allowing it to be used for such things as pistons. On ferrous materials, the plate prevents contamination of liquids by iron from pumps, pipework, containers, etc., and the corrosion resistance of the plate is claimed to be at least as good as nickel itself.

The " Phosbrite " chemical methods of polishing metals, already widely used for treating aluminium and its alloys, have now been extended to polishing copper and copper alloys. Several firms are now using Phosbrite 183 and 184 on a commercial scale for this purpose, including the Ever Ready Co. (G.B.) Ltd., who have recently installed a plant at their Wolverhampton works. The process is used for producing smooth bright surfaces on goods subsequently to be electroplated, or it can be used as a decorative finish in its own right. In a three-minute polishing period, the solutions

Fig. 2.—Alkan's newly-introduced cabinet for testing metal coatings.

remove up to 0.001 in. of metal overall, depending on the type of alloy and the amount of cold work it has received.

M. L. Alkan Ltd., Ruislip, Middlesex.

Main exhibit on this stand was a commercially built cabinet for the sulphur dioxide method of testing metal coatings. Test panels showed the results of its application to a comparison of ordinary and crack-free chromium deposits for decorative and engineering uses. The company's solutions used for crack-free chromium plating are specified as CF 520 for decorative purposes, to give a depth of 0.0001 in., and CF 500 for engineering uses, giving a depth of 0.001 in. The solutions are self-regulating.

The cabinet using the sulphur-dioxide method for testing coatings is claimed to effect a considerable saving in the time normally required to make the acetic-acid salt-spray test, 24 hours being sufficient for most purposes, according to the company.

The self-regulating solution for plating uses soluble salts added as catalysts, and an excess is always lying insoluble at the bottom of the plating tank. Temperature or chromic acid concentration variations cause a re-adjustment of concentration of catalyst salts in solution either by a precipitation or dissolving of residual catalyst. The solution equilibrium is maintained by a daily hoeing-up of the residue to ensure that it does not become blanketed by lead chromate settling to the bottom of the tank. Using the principle of self-regulation, the more exacting dilute chromic acid solution can be employed without difficulty.

Reference was also made on the stand to the "K" Cell test, an American innovation that is claimed to give more exact definition of measurement than the commonly-used Hull Cell test.

Aluminium Development Association, 33, Grosvenor Street, London, W.1.

The test instruments developed or adapted for the evaluation of anodic coatings on aluminium in accordance with B.S.1615, 1958, were shown with additional tests appropriate for certain applications. The apparatus illustrated current methods of evaluating the thickness reflectivity, corrosion resistance, abrasion resistance and the effectiveness of sealing of anodic films on aluminium.

The simple and effective device developed by Dr. G. Gardam for the visual assessment of image clarity was shown. In use, the maximum distance at which an illuminated pattern can just be resolved by the eye when viewed at a reflecting angle of 45 deg. is taken as a measure of the image clarity, shown by the reflecting surface.

Another instrument on display is used for the rapid comparison specular reflectivity, particularly suitable for the routine assessment of the quality of highly reflecting surfaces. A beam of light falls on the specimen, and the intensity of the beam is measured by a photocell and lens system. The instrument is claimed to be particularly sensitive to small changes in specular reflectivity.

There was also a standard instrument (BSS,1615, 58) for the measurement of total and diffuse reflectivity, specular reflectivity being obtained by difference. A beam of light falls on the test surface which is closely applied to a small aperture in an internally whitened sphere. The total reflected light is thus integrated, and a measure of its intensity is obtained by a photocell at the surface of the sphere, but screened from direct light by means of a diaphragm. An externally operated light-trap can be swivelled into position to absorb the specularly-reflected light from the test surface, when the photocell records the diffusely-reflected light only.

A film thickness meter manufactured by Solus Schall, and another made by Coloral Products Ltd., Birmingham, were also displayed. The measurement was made by the application of eddy currents to the coated surface.

Also shown was apparatus to test by sulphur dioxide the efficiency of sealing anodic films by the hot-water process ; the acetic acid/sodium chloride spray test for corrosion resistance ; a test for abrasion resistance by impingement of carborundum powder, the latest development in the necessary apparatus being shown ; and outdoor exposure test results for light-fastness of anodized and dyed surfaces.

Apex Construction Co. Ltd., 15 Soho Square, London, W.1.

An Apex 192 chemical pump for transferring liquids, gases or solids was shown on this stand. The pump provides an inexpensive means of pumping liquids, slurries or gases, eliminating contamination and without using expensive acid

resisting materials. The pumps operate by compressing a rubber or other plastic tube carrying the liquid between a pressure plate and a number of fingers moved in a sinuous movement by a cam shaft. The action of the fingers pressing against the tube carrying the liquid imparts a positive unidirectional movement of the liquid flow. Rates can be adjusted by the size of the tubing, the r.p.m. of the pump, and an adjustable loading that can be placed on the pressure plates. Four models are available giving a range from below 10 cc. per min. to 9000 cc. per min., and the flow rates of each of these models is variable over a wide range.

By varying the load placed on the pressure plates, the flow rate can be altered by up to 50 per cent without adjusting the speed of the pump or the tubing size ; this method of altering output is not available on the smallest size in the range. The pump on view was shown complete with a motor coupled through a small variable-speed reduction unit to provide the drive.

The Battersea College of Technology, Battersea Park Road, London, S.W.11.

Three examples demonstrated the research on corrosion in progress at the College. These were apparatus for measuring reaction rates by observing the change in electrical resistance of a metal wire ; a Piontelli electrode for studying polarisation potentials during metal deposition ; and an electrode for measuring corrosion potentials during cathodic protection.

An apparatus for the measurement of the rate of dissolution of a metal, without interrupting the process, was described with particular reference to its use for studying the chemical polishing of aluminium. The metal, in the form of a thin wire, was wound non-inductively around a glass rod which could be rotated at constant and reproducible speeds. An alternating current was passed through the wire and the potential measured, thus enabling the electrical resistance, and hence the radius of the wire, to be calculated. The rate of dissolution would thus be obtained continuously and under reproducible conditions.

A prototype version of a corrosion potential electrode was displayed by courtesy of the manufacturers. As part of a programme of work on the development of a set of industrial electrodes or half-cells that could be used in practical corrosion and cathodic protection investigations, the properties of a series of electrochemical reference electrode ($Ag\text{-}Ag_2SO_4$, $Cu\text{-}CuSO_4$, $Pb\text{-}PbCl_2$, Zn, $ZnCl_2$) were investigated. Maximum reliability under field conditions was obtained using a plastic body, wood or porcelain end-plugs, and massive electrodes. It was found necessary to enclose all electrical connections and to tint the plastic to minimise photochemical effects.

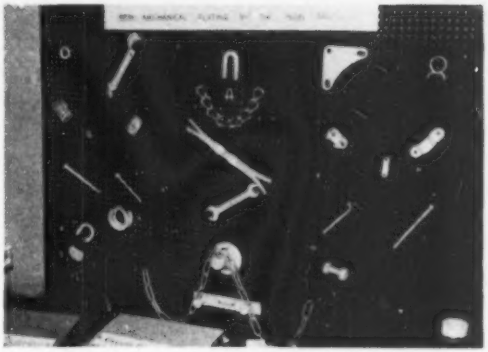


Fig. 3.—A display of "peen-plated" parts formed a backdrop to Berk's stand.

F. W. Berk and Co. Ltd., (Schori Division) North Circular Road, London, N.W.10.

Examples of sprayed metal and plastic coatings were shown on this stand with the type of spraying pistol used for their applications.

One of the main features on the stand was a display of parts that had been treated by the company's method of "peen-plating," and these included nails, hose clamps, lock washers, chains, powder metallurgy parts, springs, small stampings, etc. During the process, parts are given a suitable pre-treatment, then placed into a tumbling barrel together with impacting material, a promoter solution and the coating metal in the form of dust and water. For zinc plating, for example, the barrel is operated for 45 minutes to give a plating efficiency as high as 98 per cent, it is claimed. Peen-plated coatings of zinc can be applied to any normal thickness, and the coating can be put on to highly tempered objects such as spring lock washers without danger of hydrogen embrittlement. Sintered powders can be plated without danger of subsequent corrosion from an absorbed electrolyte.

British Iron and Steel Research Association, 140, Battersea Park Road, London, S.W.11.

A typical investigation made by the Association's corrosion advice bureau formed the exhibition on the stand. Severe corrosion of the condensate return lines of a steam system was shown to be due to the decomposition of sodium carbonate added to the feed water.

Cambridge University Department of Metallurgy, Pembroke Street, Cambridge.

Results were displayed for an electrometric method of measuring the thickness of oxide films on iron and for its application to the problem of corrosion inhibition. With proper precautions, the thickness of the air-formed film on iron can

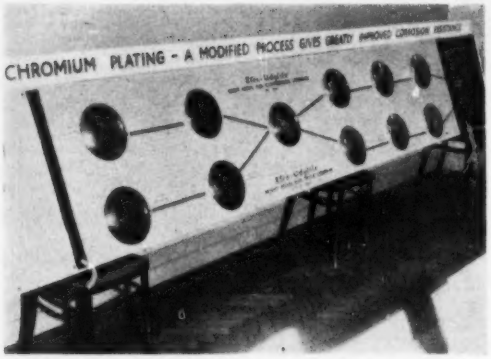


Fig. 4.—Car wheel discs demonstrated the stages in Efco's plating processes.

be estimated by measuring the number of coulombs used in reducing the oxide to metal. Certain inhibitors of corrosion thicken the air-formed film by 20-120 per cent. depending on the inhibitor and the condition of the metal surface.

W. Canning and Co. Ltd., 77, St. John Street, London, E.C.1.

The display on this stand included both the conventional type of salt-spray cabinet and their new acetic acid-salt spray chamber that has been designed to comply with the requirements of A.S.T.M. B.117/547, B.287/547, and the proposed revision, now in draft form, of B.S.S. 1224. Specimens of plated work that had been exposed in both types of spray were shown. The improved model of the B.N.F. Jet Test apparatus, complete with a stop clock and a set of test reagents, completed the exhibit.

The salt spray cabinet, constructed in Perspex, is provided with a water jacket to permit tests to be carried out at elevated temperature.

The Cromford Colour Co. Ltd., Cromford, Matlock, Derbyshire.

The exhibit illustrated storage tests and laboratory performance tests of one-pack wash primers. Barium chromate was shown to be a better pigment for this purpose than those in current use, according to the company.

Central Electricity Generating Board, Research and Development Dept., 24/30 Holborn, London, E.C.1.

A sea-water corrosion testing apparatus, used for corrosion tests on materials found in the cooling systems of power stations, was shown on this stand. Two specimens were clamped face to face, filling the windows in a Perspex holder sandwiched between the specimens, and local water was pumped through the holder. Water velocity could be varied, and re-circulated through the apparatus more than once if required. One of the specimens (platinum) was acting as an auxiliary electrode, and an external D.C. amplifier was maintaining the potential of the observed specimen at a given value with respect to a standard half-cell An austenitic stainless steel specimen was being maintained at a potential of -580 mV. with respect to a saturated calomel electrode, while the pump was being switched on and off at regular intervals to show the effect of water velocity on the current required to maintain this potential. Specimen potential was being recorded on a Brown Electronik recording potentiometer (Honeywell Controls Ltd.); the D.C. amplifier was a galvanometer with photocell arrangement (H. Tinsley and Co. Ltd.); specimen polarising current was being recorded on a Recorded recorder, 0-5mA ; the water pump was switched with a Venner time switch as used in cathodic protection interference testing. Specimen potential was measured with a saturated calomel halfcell (Cambridge Instruments) and controlled with a silver/silver chloride halfcell. Studies of this kind are being used to assess the corrosion likely to occur in large cast iron bodied valves having stainless steel sliding faces.

Electrochemical Engineering Co. Ltd., Sheerwater, Woking, Surrey.

The exhibit here consisted of a number of car wheel discs showing the various stages in the electro-plating sequence required to produce a bright nickel and chromium deposit. The importance of the final chromium coating on corrosion resistance was emphasized and the use of a modified chromium-plating solution which gave greatly improved corrosion resistance was illustrated.

University of Exeter Chemistry Department, Exeter.

On this stand, four exhibits relating to the examination of oxide layers on metal were shown. The exhibits comprised :—

(a) The measurement of oxide layer growth by a vacuum micro-balance. The instrument had a beam of fused quartz mounted in a tungsten wire (10 micron dia.) stretched across a frame of fused quartz. The range was 1200 x 10-6g. and the sensitivity 0.5 x 10-6g.

(b) Estimation of the specific surface of metal oxides by adsorption of Krypton at -195°C. The surface is calculated from the uptake of the gas, measured volumetrically. The precision was about 100 cm^2.

(c) Determination of the density of metal oxide by density bottle. The liquid (mercury,

organic liquid or water) was added to the outgassed solid in a vacuum system by distillation or siphoning. Precision was about 0.0003cm^3.

(d) Specimens of magnesium surfaces oxidised in dry and moist oxygen.

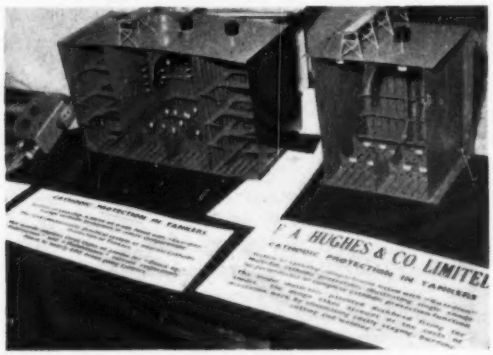
Forestal Land Timber and Railways Co. Ltd., Central Laboratories, Harpenden, Herts.

The use of tannin-based wash primers as pretreatments for rusty steel surfaces was illustrated. Examples were shown of the different methods of application with their effect in modifying the breakdown of paint films on exposure and the corresponding reduction of corrosion of the underlying metal. New metal tannates having an improved colour range were also shown.

Some results of tests on rusty metal were illustrated in the exhibit. For these tests, the steel panels were rusted by external weathering, then wire brushed to remove loose rust particles without brushing down to bare metal. After tannin wash primer treatment they were painted with ordinary red oxide undercoat and exterior grade white topcoat and weathered externally for eighteen months. Pronounced pitting of the metal surface developed during this period in the case of the control plate that had received no tannin treatment, with obviously severe damage to the paint system. The pitting was greatly reduced where a single coat of the tannin wash primer had been applied and was almost completely eliminated where two coats of wash primer were applied with a light wire brushing between coats. The corresponding reduction in damage to the paint system in these cases was very marked.

Examples were also shown of experimental pigments of metallic tannates having an improved range of colours. The properties of these pigments were still being studied, but it is known that some exhibit powerful anti-corrosive properties when incorporated into conventional paint systems,

Fig. 6.—Hughes internal cathodic protection.



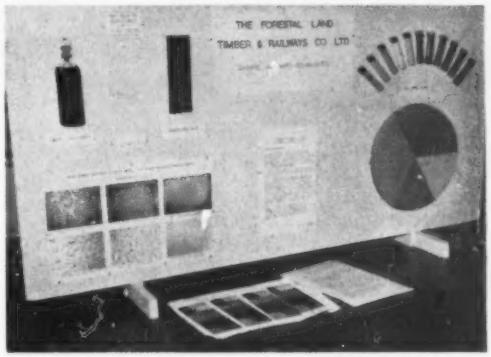


Fig. 5.—Forestal struck a topical note, referring to recent work on London's " Big Ben "

the company says. The anti-corrosive metallic tannates are the subject of a patent application submitted jointly in the names of the Forestal Co. and the Paint Research Station.

Fulmer Research Institute Ltd., Holly Hill, Stoke Poges, Bucks.

Reflexion electron micrographs showed the oxide growth in air and steam at 700°C on mild steel and steel containing 2.5 per cent. Si and 1 per cent. Al. Specimens of the steels were mechanically polished and then exposed to the oxidising conditions for various periods before examination by reflexion electron microscopy. Needle and plate shaped oxide growths could be seen.

F. A. Hughes and Co. Ltd., 4, Stanhope Gate, London, W.1.

" Guardion " instruments and anodes for use in cathodic protection were shown and examples of their application were illustrated. These included :

A corrosion voltmeter, for accurate instantaneous solution potential measurements ; a transistorised resistivity meter (range 15-65000 ohm cm) for rapid accurate measurement of soil resistivity : a silicon iron anode for low consumption and dependability of performance in permanent ground beds ; internal cathodic protection for tankers was illustrated by models showing two systems, one with three stage protection using three types of anode and one using the multi-fin anode to give the complete range of protective functions with one anode. The merits of careful design for installation of the system were brought out ; anodes used for ships' hull protection were displayed to illustrate the satisfactory corrosion pattern and bonding of core to parent metal.

Imperial Chemical Industries Ltd., (Metals Division), Witton, Birmingham, 6.

Three exhibits illustrated the research carried

out in the application of the newer metals. These were :—

(a) The comparative cost and corrosion behaviour of tantalum, niobium, zirconium, beryllium and titanium were presented schematically in a coloured three dimensional display. Corrosion test specimens of the metals were shown and the behaviour of anodically passivated titanium was compared with that of the unprotected metal.

(b) Designs of platinised titanium electrodes were shown, and an indication was given of the uses made of such electrodes, including a working illustration of one application.

(c) The testing of metals for nuclear engineering was illustrated by diagrams showing the neutron capture cross-section and compatibility with the heat transfer medium for several metals. Corrosion testing techniques were shown and specimens were displayed to illustrate the effect of small variations in composition on the corrosion resistance of zirconium.

International Research and Development Laboratories, 200, Elgar Road, Reading.

Apparatus used in the study of the attack of ammonia solutions on copper and its alloys were shown. The test piece was in the form of a rotating disc and examples were shown before and after corrosion, etched to show the flow patterns obtained. Diagrams indicated some results.

Jenolite Ltd., 13/17, Rathbone Street, London W.1.

A range of solutions for surface treatment of metals was shown here including the " Jenocote " and " Jenolite " solutions for rust removal, " Jenolite " chemical sealer for treating steel reinforcement for concrete, " Jenotan " for combined phosphate and tannin treatment of steel and other solutions for treatment of steel and aluminium.

Arthur D. Little Research Institute, Inveresk, Midlothian.

A method of measuring the rate of evolution of hydrogen anaerobic corrosion of metals was illustrated on this stand. The hydrogen was carried forward by a stream of nitrogen and combusted after the addition of a constant trace of oxygen. The subsequent level of oxygen content was then measured by a highly sensitive galvanic system.

London County Council (Scientific Adviser), County Hall, London, S.E.1.

Various examples of corrosion troubles encountered in the L.C.C's wide experience with buildings and engineering equipment were shown. The serious deterioration to be seen arose in general from the wrong choice of metal or from inadequate protective measures, indicating the need for more attention to corrosion prevention at the design stage. The troubles illustrated could be overcome and should not be regarded as typical of the behaviour of the constructional materials concerned.

The examples were grouped as " external " and " internal " specimens. Those in the former category included the familiar " white rust " on zinc sheet and hinges due to storage under damp conditions, and exfoliated corrosion continuing under the paint film on an aluminium alloy of high copper content (3 per cent.) due to poor preparation and the use of an unsatisfactory primer. The wrong use of aluminium for a specific purpose was illustrated by the example shown of a soot-door frame, made of the material, after 6 months service on a domestic hot water boiler flue. The combined action of water vapour, carbon dioxide and sulphur dioxide in the flue gases had resulted in heavy corrosion. A gunmetal stay bolt from a fire fighting pump showed the erosion of the metal by the turbulent impact of water at high velocity.

Examples of internal corrosion included an aluminium rainwater pipe ; the corrosion was due to traces of copper in the rainwater derived from copper telephone wires above the roof. An aluminium kettle had also corroded because the copper sheath of the heating element had not been tinned. A case of internal corrosion still under investigation was a copper cold water pipe carrying London hard mains water and it is thought that the trouble had been caused by one of three possible causes :—carbon deposits from oil used on the drawing die ; other imperfections on the internal surfaces ; stray current leaks from electrical appliances (in this case, cookers, boiling pans, and radio sets). A widespread problem of internal corrosion was illustrated by a section of pipe from a hot water heating system. Symptoms are air locking of radiators due mainly to nitrogen gas evolved, and the blockage of small pipes by the copious black sludge produced, a mixture of black iron oxide and iron sulphide. The cure for this was considered to be sterilization of the systems affected with Acriflaven in a dosage of 20 p.p.m. in the water. More recently, dichlorophen in the same dosage had been used with equal success.

Metal and Pipeline Endurance Ltd., 30, London Road, Woolmer Green, Knebworth, Herts.

Apparatus used in the application of cathodic protection was shown, including a soil resistivity test, a redox probe, platinised titanium anodes, a platinium-lead bi-electrode and a multi-range test set.

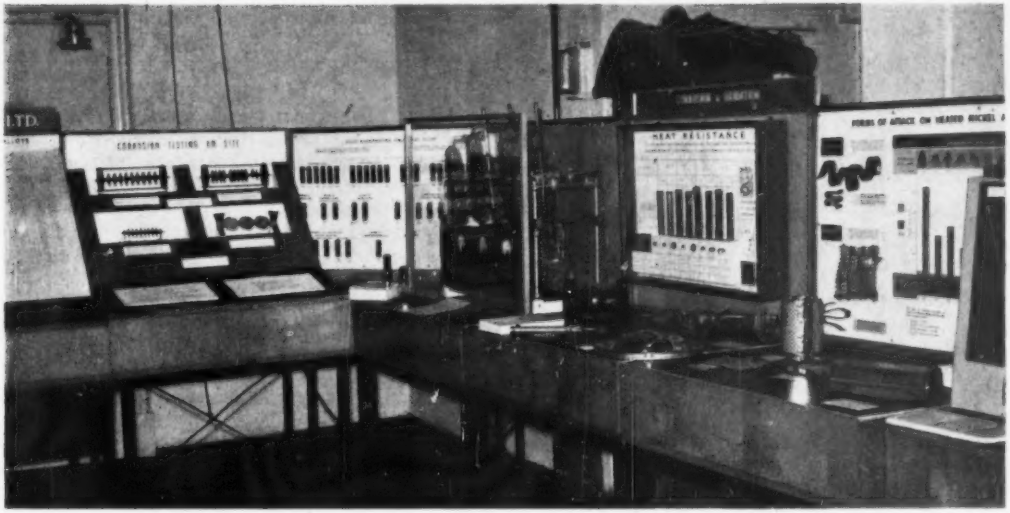


Fig. 7.—Taking up half the stage area in the main hall, Mond Nickel's exhibit was the corrosion section of their Nickel Exhibition that toured the U. K. recently.

The redox probe for assessing corrosiveness of soils had been developed for measuring the redox potentials of soils to assess whether the composition of the soil was conducive to the multiplication of sulphate reducing bacteria. Multiplication of bacteria depends upon many factors, one of which was the redox potential.

The introduction of a very small piece of platinum wire into pure lead has been found to have a remarkable effect on the behaviour of lead when anodically polarised. The anodes shown had both been polarised in 3 per cent. sodium chloride solution at 30 amp. per sq. ft. for twelve hours. The one which contained a very small piece of platinum wire formed a lead peroxide film, and this anode could be used without destruction of the metal for prolonged periods. The pure lead anode was being rapidly converted into a voluminous lead chloride or oxychloride. More prolonged periods of corrosion would result in a more complete disintegration of the metal.

A demonstration of the anodic polarisation of lead containing platinum micro-electrodes was also on view. Two electrodes were being polarised at 30 amp. per sq. ft. in sodium chloride solution. One electrode contained two small pieces of platinum wire. It was shown that with the pure lead alone the voltage steadily increased, whereas, with the platinum present in the lead, the voltage remained constant at a comparatively low voltage.

Metallic Surfaces Research Laboratories Ltd., The Market House, Uxbridge, Middx.

Exhibits on this stand were divided into two sections :—

Research

(a) Apparatus and rigs for the study of brittle fracture of ultra-high-tensile steels under sustained load.

(b) Specimens and photomicrographs illustrating treatments by diffusion of nickel base alloys for protection against thermal oxidation and thermal corrosion.

(c) Samples and photomicrographs of molybdenum test-pieces protected by various metallic coatings.

(d) Examples of chromising obtained on iron samples by very short treatments (a few minutes) by means of a high frequency generator.

" Arkrom " Diffusion.

Samples of applications of " Arkrom " diffusion for resistance to corrosion and heat included bolts, nuts, threaded parts, sheet blanks for subsequent forming, parts for paraffin stoves and gas cookers, gas pokers, etc.

Another exhibit was a small tube furnace and processing kit that will be available to prospective licencees for the " Arkrom " chromising processes, who wish to carry out experimental work in their laboratory before utilising the processes on a production scale. These small inexpensive laboratory units are designed to show the essential features of the process, and can be installed and operated from an ordinary 15-amp. plug without any other fittings, other than a pyrometer.

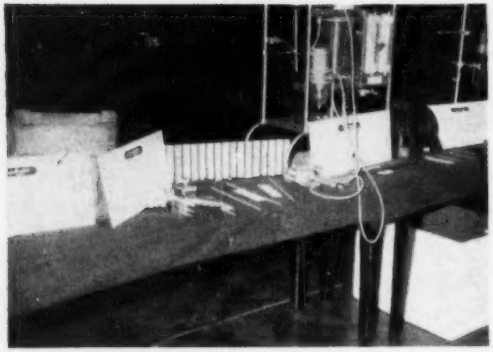


Fig. 8.—Apparatus and industrial products formed Metallisation's exhibit.

Metallisation Ltd., Barclays Bank Chambers, Dudley, Worcs.

Several exhibits illustrated research and development for sprayed metal coatings and these included :

(a) Spraying apparatus to produce coatings on various metals, plastics, and ceramics.
(b) Apparatus for the estimation of permability of coatings.
(c) Fundamental research on sprayed aluminium and magnesium.
(d) Apparatus to test coatings in hot solutions and condensed vapours.

Mond Nickel Co. Ltd., Thames House, Millbank, London S.W.1.

A display illustrating the corrosion resistance of nickel and nickel-containing materials included stereo-photographs of types of corrosion and an automatic indicator for selection of materials. Working models of laboratory test apparatus were displayed and details were given of the company's service for testing the corrosion resistance of metals in working plant. In addition, the tarnish resistance of platinum alloys at high temperature were illustrated.

Nash and Thompson Ltd., Oakcroft Road, Chessington, Surrey.

Instruments and ancillary apparatus for the measurement of soil resistivity were shown including :—A corrosion model Tellohm soil resistance meter, a portable battery-operated instrument with seven ranges from 0.3 ohm. to 10,000 ohm. full scale ; a geophysical model Tellohm soil resistance meter, a more sensitive instrument ; probes, selector box and switch-box for use with the instruments.

National Chemical Laboratory, D.S.I.R., Teddington, Middlesex.

The variety of the corrosion research carried out at the N.C.L. (formerly C.R.L.) was illustrated by exhibits showing the growth of coloured films on cathodic surfaces ; polytrifluorethylene coatings for masking experimental specimens ; photographs of a water circulation system designed in the laboratory ; and an unusual type of corrosion product formed in fast flowing water at 55°C.

At the laboratory, three circulation systems have been designed and constructed to investigate the corrosion of metal pipes in flowing water at various temperatures.

Photographs illustrating the work showed that the test solution was pumped from a 100-gal. glass tank at ground level by a ceramic-lined centrifugal pump into a 40-gal. header tank mounted on a platform. The water returned to the lower tank through vertical and horizontal specimen lengths of pipe, the excess being carried through an overflow pipe. Glass tubing was used throughout and no metals other than the test specimens were included in the circuit. The rate of flow of liquid through the specimens was indicated on flowmeters, checked regularly. The influence of temperature was being investigated by carrying out tests at 25, 40 and 55°C., the water being maintained at these temperatures by a silica-sheathed immersion heater in the lower tank and a bimetal regulator in the upper tank.

Specimens were supported in metal clips electrically insulated from the main supporting frame and they were electrically insulated one from another by means of polytetrafluorethylene washers. The clips were wired to a central electrical connection board, enabling the electrode potential of the specimens to be measured during test. Loss of heat from the specimens was prevented by enclosing them in a box, covered with transparent plastic to enable the specimens to be viewed, which was heated to the same temperature as the test solution.

Fig. 9.—Instruments for measuring soil resistivity on Nash and Thompson's stand.

Provision had been made for measuring the electrical conductivity of the test solution by by-passing some of the solution through a conductivity cell. Alkalinity and *p*H were also measured as a routine procedure. De-ionized water (conductivity $< 1.10^{6}$ mho.) was used for making up the test solutions and for replacing water lost by evaporation.

Specimens were removed at regular intervals during the test to give results for exposures of 2, 4, 6, 8 and 10 weeks. The corrosion was assessed by visual examination and photography and by the loss in weight after corrosion products and scale had been removed by suitable cleaning.

Paint Research Station, Waldegrave Road, Teddington, Middlesex.

The exhibit showed the structure of paint films as deduced from electron-micrographs of film surfaces and sections. A technique for studying by electrode potential measurements the protection given by a paint film was also shown.

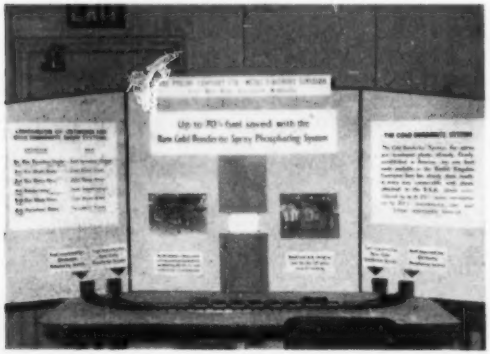
The Pyrene Company Ltd., Great West Road, Brentford, Middlesex.

Progress in the phosphate paint bonding treatments was illustrated by details of the recently introduced Cold Bonderite system. The sequence of operations for this and the old established hot process were compared, treated panels were shown and there were photographs of the new process in commercial use. The fuel saving by the use of the cold system were illustrated by two model electric trains pulling the coal loads required for the cold and hot systems respectively.

Shell Chemical Co. Ltd., 170, Piccadilly, London, W.1.

The performance of protective coatings based on " Epikote " resins was illustrated by a number of tests. The resistance of Epikote resin/coal tar

Fig. 11.—*The Pyrene Co. used model trains to illustrate the economy of the Cold Bonderite system.*



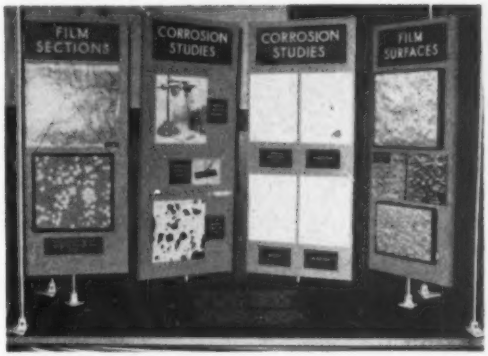


Fig. 10.—*Illuminated panels demonstrated the structure of paint films on the Paint Research Station's stand*

combinations to distilled water and 10% NaOH was demonstrated by one year test specimens ; nine steel panels coated with Epikote resin stoving enamels were shown part immersed in distilled water. They had been so immersed at 40°C. for 4000-hrs. before the exhibition ; Epikote resin marine paints were shown under test in 50/50 artificial sea-water and aviation gasoline and in aerated artificial sea-water after two years.

Silvercrown Ltd., 178, Goswell Road, London, E.C.1.

Production samples of electroplating processes for fast and bright deposition of metals for decorative and protective coatings were shown. These included bright nickel deposits of high flexibility, fully bright cadmium and zinc deposits, bright hard silver for electrical contacts, and tin-bronze. Photographs of newly installed plants were also shown.

Talbot Stead Tube Co. Ltd., Green Lane, Walsall, Staffs.

A range of corrosion resisting tubes and fittings was shown including stainless and heat-resisting tubes ; bi-metal tubes to give the corrosion resistance required on both sides ; Metior stainless fittings for the dairy, food and brewing industries ; a Cupford diaphragm valve, claimed to be the first 3-way valve of its kind ; Metica metal-clad carbon and graphite tube ; and stainless steel Swirlyflo tubes.

The Tin Research Institute, Fraser Road, Greenford, Middlesex.

A method of obtaining by electrochemical measurements a numerical index of the porosity of tin, tin-nickel, nickel and speculum coatings was illustrated by an explanation of the method and by results of tests. The test piece was made the

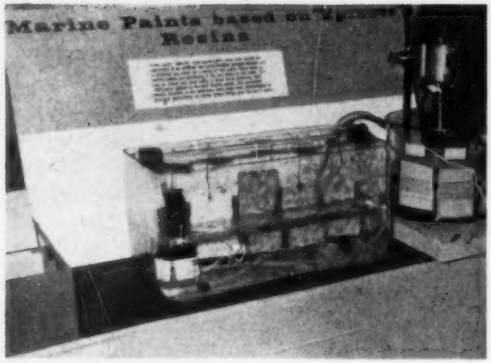


Fig. 12.—Shell's "Epikote" resin stoving enamels on immersed panels.

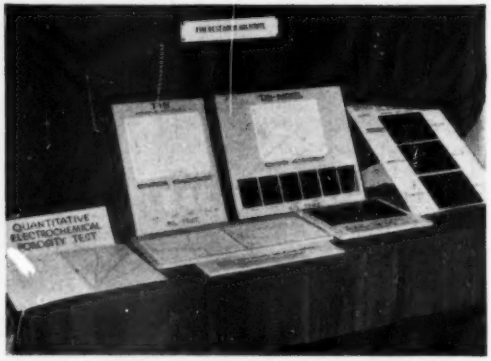


Fig. 13.—Tin Research illustrated a method of obtaining a numerical index of porosity in certain metals.

anode in a cell in conditions such that the current flow was almost entirely via the basis metal exposed at pores, and the polarisation of the basis metal was insensitive to current changes. The potential measured outside the coating then varied linearly with changes of current and the slope of the line was believed to be an index of the resistance of electrolyte within the pore channels.

Wallace and Tiernan Ltd., Electro Rust-proofing Division, Power Road, London, W.4.

Test equipment of special application in cathodic protection was shown including : Miller multi-combination corrosion test instruments ; a D.C. current interrupter designed to open and close alternately a test current circuit at selected time intervals ; an E.R.P. field test instrument with potentiometer voltmeter/ammeter ranges ; and an E.R.P. battery-operated valve voltmeter with 10 megohm impedance, 1 and 2 V. ranges.

Winn and Coales Ltd., Denso House, Chapel Road, London, S.E.27.

Exhibits included equipment for electrical resistance measurements, field test specimens exposed for 20 years with and without protective coatings, laboratory specimens showing the difference between protected and unprotected metals in the presence of sulphate-reducing bacteria, and equipment for electrical resistance measurement.

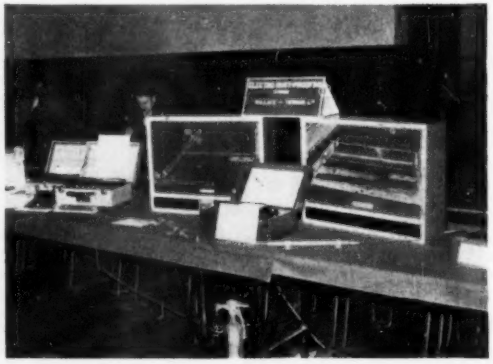
Photographs showed anaerobic tanks containing protected pipes immersed in an active culture of sulphate reducing bacteria (Desulphovibrio desulphuricians). The efficacy of various bacteriostatic or bactericidal agents could thus be ascertained under controlled accelerated conditions by examination of the pipes after given periods.

A McIntosh-Fildes anaerobic jar, demonstrated a method of maintaining an anaerobic environment for the study of bacteria. After exhausting and filling with nitrogen and/or hydrogen with traces of carbondioxide, an electric current was passed through a palladinised coil in the lid of the jar, thus reacting any traces of oxygen which may have persisted. By the use of this apparatus the incubation in Baar's medium of soils can be studied to give a working estimate of the activity of sulphate reducing bacteria.

A mounted specimen and microphotograph illustrated an example of graphitisation of a phosphoric grey cast iron main by sulphate reducing bacteria.

Also shown was the assessment of changes in electrical resistance for protective systems under buried conditions by means of an A.C. bridge. The protected pipes were partially immersed in N/10 sodium chloride solution or moist saline earth for 250 days. At recognised intervals the electrical resistance and electrical capacitance was determined by an A.C. bridge detector operating at 1592 cycles. The electrical resistance was expressed in Ohms per sq. decimeter, and the resultant resistance plotted graphically against time.

Fig. 14.—Cathodic protection was also the feature on Wallace and Tiernan's stand.



INSTITUTE OF METAL FINISHING

Report of Annual General Meeting

THE Annual General Meeting of the Institute of Metal Finishing was held at the James Watt Memorial Institute, Birmingham, on Tuesday, December, 2, 1958. The president, Dr. T. P. Hoar, was in the chair, and, in the absence abroad of Dr. S. Wernick, the honorary secretary, read the notice convening the meeting.

The minutes of the previous annual general meeting, held on November 18, 1957, having been duly circulated to members in the Winter (1957-58) *Bulletin*, were taken as read and were signed by the chairman.

Honorary Treasurer's Report

In the absence of Mr. F. L. James, who relinquished the Honorary Treasurership at the end of the Session, and of Dr. L. B. Hunt, chairman of the Finance Committee, Dr. J. E. Garside, newly-elected Honorary Treasurer, presented the accounts.

Summarizing the general position, Dr. Garside said the accounts could be regarded as satisfactory, justifying a sober optimism that a credit balance could be expected in the not too distant future. There was little doubt that the new method of publishing the Institute's *Transactions* recently introduced would permit of considerable economies being effected.

In response to the chairman's invitation to members for comments on the Balance Sheet and Income and Expenditure Account a member queried the item " Publications and Development " which appears on both sides of the Balance Sheet but is left blank. The chairman explained that the item arose originally many years ago as a result of generous donations from industry for the purpose of assisting the Institute in its main work of publication. The sum donated has long since been expended in such cause, but the item is retained in the Balance Sheet as a reminder and in the hope and expectation that, in the not too distant future, further donations from industrial friends may be received for the same purpose, the need for which remains as great or greater than ever.

Annual Report of Council for the 33rd Session, 1957-58

In the unavoidable absence of the honorary secretary, the Chairman read this Report prepared by Dr. S. Wernick.

The thirty-third session has proved to be a notable year in at least three important respects. These are the implementation of plans to effect a fundamental change in the character of the Institute's publications ; the retirement from office of the honorary treasurer, Mr. F. L. James, after 28 years' unbroken service, and, third, the planning of the Fifth International Conference on Electrodeposition and Metal Finishing (which will be held this year in the United States) in close liaison with the American Electroplaters' Society.

The slight increase in membership, amounting to no more than ten for the year despite an intake of over 100 new members, following as it does a similar moderate increase in the previous year, was not considered satisfactory by Council. As a result, a decision was taken to set up a Membership Committee under the chairmanship of Mr. R. A. F. Hammond, charged with the task of launching a membership drive. This Committee, consisting of Mr. I. S. Hallows, Mr. J. Hooper, Dr. L. B. Hunt, Mr. H. Silman and Dr. Wernick, in addition to the chairman, has been actively engaged in compiling an attractive illustrated pamphlet indicating the aims and achievements of the Institute.

Technical Meetings

The technical activities of all Branches were maintained at a satisfactory level throughout the Session.

The Annual Conference held at Torquay from April 15 to 19 exceeded expectations in the matter of attendance, for as many as five hotels, including two of the largest in the town, had to be called upon to accommodate the 348 delegates and their ladies. Many of the delegates had to undertake a long daily journey to the Conference headquarters. Included were 30 overseas visitors, or twice as many as those who attended the 1957 (Brighton) Conference. Seven countries were represented : an outstanding delegation from Germany accounted for no fewer than 18 delegates.

The Conference followed the pattern set in previous years, Papers presented at the five technical sessions produced lively and informed discussions. A succession of social occasions, beginning with a reception by the Mayor and Corporation of Torquay and ending with the Conference Dinner and Dance helped to produce that spirit of good fellowship which invariably pervades these popular annual events.

Education

An important development in the matter of the Metal Finishing and Allied Industries Apprenticeship Scheme, to the initial stages of which reference was made in the last Annual Report, is its recognition by the Ministry of Labour and National Service to the extent that young men engaged as

(*Continued in page* 70)

Institute of Metal Finishing

(*Continued from page* 69)

apprentices by "approved employers" will be exempt from military call-up.

The Education Committee (under the Chairmanship of Dr. Garside) has co-operated closely with the City and Guilds of London Institute in arranging courses and examinations in metal finishing. Progress has also been made in securing the co-operation of industrial organizations to register as "approved employers." These firms have agreed to release senior staff for attendance at approved courses and have offered prizes to successful students and provided financial assistance to colleges and universities for equipment, instruction and research.

Mr. F. L. James

During the Session the Institute has lost the services of one of its oldest Executive Officers as a result of the retirement of Mr. F. L. James, its Honorary Treasurer since 1930. A founder member of the Institute, Mr. James can in fact claim that he has been active in the treasurer's department from the very first day of existance of the original "Electroplaters' and Depositors' Technical Society" forerunner of the "E.T.S." and the "I.M.F." His father, the late Mr. William James, was the first Honorary Treasurer, but at the inaugural meeting his son was present and helped to collect the first subscriptions !

A tribute was paid to Mr. James in an editorial in the Summer, 1958, issue of the *Bulletin*. As a slight token of gratitude for his herculean labours on behalf of the Institute over the last 28 years Council decided to open a Testimonial Fund to be subscribed exclusively by members of the Institute with a view to making him a suitable presentation during the new Session. In the meantime, Council wishes to express its heartiest thanks to Mr. James on behalf of all members for his sterling work and most valuable services.

Medals and Awards

No award was made during the Session of the Gold Medal, the Hothersall Memorial Medal or the Johnson Matthey silver Medal. The Westinghouse Brake and Signal Company's prize was awarded to Mr. S. A. Watson and Dr. J. Edwards for their paper entitled "An Investigation of the Mechanism of Levelling in Electrodeposition."

Both authors were present and received their awards from Mr. L. E. Thompson, Director, Westinghouse Brake and Signal Co. Ltd.

The Chairman then moved a vote of thanks to the honary officers, members of committees and paid special tribute to the office staff, particularly Mrs. C. Sieff.

Costing in the Metal Finishing Industry

(*Continued from page* 53)

the fixed expense may be pared as a result of the closure. With records available this calculation is possible to a fair degree of accuracy but the imminence and cost of any large-scale repair would need to be taken into consideration.

In better times the need often arises to consider the replacement of old if not obsolete plant by a more modern installation. Again it is only by detailed analyses of total cost that a clear indication can be given of the total effect of any benefit that may be expected to arise from improved production, reduced staffing, material economies, better control, its effect on the reject percentages and/or many other sources of saving which might be possible with a more modern plant. Against this must be set the increase in capital employed and the higher depreciation charges which probably arise.

Conclusion

In the opening remarks the author assumed that most of the small plating concerns make little use of costs beyond the direct stage. It is hoped that this paper may be of interest to them and that they will consider the gradual extension of their cost information, selecting initially the items most important to their particular business and continuing the process of extension until they can quote with the utmost of confidence in the knowledge that the price is based upon carefully controlled economic costs and cannot be under-cut except at the expense of profit or quality.

The larger out-platers and the manufacturers plating departments will no doubt have a full costing system already installed and from their point of view this contribution must be largely elementary. They will, however, find some items of procedure not in line with previously recorded methods of allocation and recovery, which may arouse their interest and (who knows) renew the desire for a basically uniform system for the industry which may be applied in a simplified form by the small man and extended to cover the more detailed analysis and control so necessary to the larger unit.

References

(1) Harrison, R. W., A.C.W.A., "Standard Costing of Plating Processes," *Journal of the Electrodepositors' Technical Society*, 1943, 19.

(2) Wallbank, A.W. B.Sc., F.R.I.C., "Electroplating Shop Costing," *Journal of the Electrodepositors' Technical Society*, 1947, 22.

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FINISHING NEWS REVIEW

STATE DEPT.'S SCIENCE ATTACHES

THE U.S. Department of State recently announced the appointment of seven distinguished American scientists to serve as "Science Officers" in U.S. embassies abroad. Dr. Thomas H. Osgood, formerly dean of the School for Advanced Graduate Studies at Michigan State University, is coming to London, and will serve in the Grosvenor Square embassy for two years. The appointments have been made under the Department's science programme; the science officer will advise the Ambassador" in the evaluation of the interaction of science with foreign policy," and the assessment of current scientific progress in the country where he is stationed. In Washington, 24 countries maintain scientific attaches in their embassies.

TREVELYAN TRUST – 1st REPORT

Industry-Backed Scholarships For Nineteen Awarded

THE first awards of Trevelyan scholarships have been made by the Trust, and its chairman, Sir Walter Benton Jones, and the chairman of the selection committee appointed by the Trust, have made a statement about the aims of the trust and the selection procedure.

This Trust was set up to provide, for a period of years, a number of awards tenable at Oxford and Cambridge Universities, to be granted to boys judged to possess exceptional personal qualities in addition to the necessary intellectual ability.

Among the companies sponsoring the scheme are English Electric Co. Ltd., Guest Keen & Nettlefolds Ltd., John Summers & Sons Ltd., Rolls-Royce Ltd., Steel Company of Wales Ltd., and The United Steel Companies Ltd., and sufficient funds have been subscribed to allow the annual award of not less than 34 three-year scholarships of £450 per annum over a period of five years.

Applications were first considered, according to the applicants' first choice, by a panel of college tutors and other senior members of the university, and projects were assessed by experts in the field covered by each project. "Short lists" of candidates were agreed upon for final interview by a selection committee which comprised, in addition to the chairman, Sir Henry Willink, two members from Oxford University, two from Cambridge and two from industry. The selection committee maintained an extremely rigorous standard and restricted the number of awards to 19, 10 tenable at Oxford and 9 at Cambridge. The awards are subject to the recipients obtaining a place at Oxford or Cambridge, but the majority have already done so, and the selectors were much impressed by the originality and level of attainments of the candidates, and hope that this high standard will be maintained in future years.

CONTINENTAL SHOP WINDOW FOR BRITAIN

THE Liege International Fair is held each year as a complement to the more famous Brussels fair, standing in much the same relationship as Birmingham to London during the old B.I.F. The Liege fair is divided into twenty industrial groups and one of these is devoted to metal finishing. There are sections for equipment used in the various processes, and for paints and varnishes, metal coverings, etc. This year, the fair will have three special exhibitions, including industrial chemistry and water engineering. A quarter of a million people attended last year, viewing a display put on by more than 500 exhibitors who numbered many from this country. Below is a general view of part of the ten-acre site along the banks of the Meuse, looking across the open air section to one of the two spacious exhibition halls. Because of the developments that have taken place in the E.C.M., the fair attains a new significance for British manufacturers. Date for the fair is April 25 — May 10.

"DANGEROUS GOODS" RAIL REGULATIONS

REVISED regulations regarding the carriage of dangerous goods by rail are contained in the second edition of the International Convention on this subject, published recently. Changes in the regulations have been necessitated owing to rapid advances in technology relating to dangerous goods and particularly regarding the transport of gases and inflammable liquids in tank wagons; there are also new rules about the handling of peroxides. Also contained in the booklet is an index of the substances affected, the method of labelling and entries required on consignment notes. Entitled "International Convention concerning the Carriage of Goods by Rail: Annex 1, Second Edition, 1958" the booklet may be obtained from H. M. Stationery Office, price 10/-.

I.M.F. SUBSCRIPTION FEES OFF INCOME TAX

THE Institute of Metal Finishing announce that the Commissioners of Inland Revenue have approved the Institute for the purposes of Section 16, Finance Act, 1958. The whole of the annual subscription paid by a member who qualifies for relief under that Section will be allowable as a deduction from his emoluments assessable to income tax under Schedule E.

Members wishing to claim relief under this head should apply to their tax offices for form P.358 on which to make a claim for adjustment of P.A.Y.E. coding.

CIBA RESEARCH FELLOWSHIPS

U.K. Graduates to study on Continent

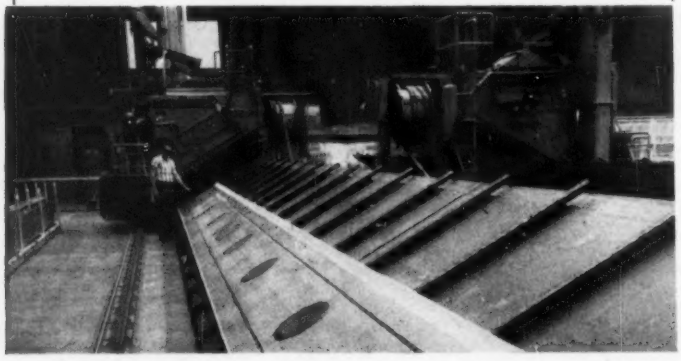
A FELLOWSHIP trust has been founded by CIBA (A.R.L.), Ltd., Duxford, Cambs. for the purpose of improving and increasing the interchange of ideas between scientists in the United Kingdom and on the Continent. The trustees are: Sir Arthur Vere Harvey, C.B.E., M.P., Lord Hives, C.H., Professor Sir Alexander R. Todd, F.R.S. The Fellowships will be awarded by an advisory panel, consisting of: Sir Arthur Vere Harvey (*chairman*); Professor A. J. Birch, University of Manchester; Professor W. Bradley, University of Leeds; Dr. A. Brunner, CIBA Ltd., Basle; Dr. E. Brunner, The Clayton Aniline Co. Ltd., Manchester; Professor D. H. Everett, University of Bristol; Professor D. M. Newitt, University of London; Dr. R. F. Webb, CIBA (A.R.L.) Ltd., Duxford.

Several fellowships will be awarded for tenure during the academic year 1959-60 at continental universities or institutions for research in chemistry, physics, or some other allied scientific subject. They will be awarded to graduates of universities situated in the U.K. or in the Republic of Ireland, or to members of those universities graduating this year. It is anticipated that some Fellowships will be awarded to recent graduates and other Fellowships to candidates who have already taken their Ph.D., or who have already spent some time in industry. Further details are available from the Secretary of the CIBA Fellowship Trust, CIBA (A.R.L.) Ltd., Duxford.

Martonair Sales Conference

TWENTY technical sales representatives from the U.K. recently attended a conference held by Martonair Ltd. at the Star and Garter Hotel, Richmond, when new developments in and advance information concerning the technique of pneumatics were discussed, to ensure that a high standard of technical service may be given to the firm's customers.

SHOT PEENING FOR U.S. PLANT



THE Boeing Airplane Co. is using shot peening equipment at its Wichita plant for both stress relieving and contouring parts for the B-52 bomber. A product of the Metal Improvement Equipment Co., the Peenamatic unit has a work-table track 96 ft. long and can handle material as large as 75 ft. long and 6 ft. wide.

Boeing has found that shot peening has proved faster, simpler, cheaper and better all round than rolling, die forming or heat treatment, according to a recent report. Wing panels have been peened for 30 minutes. The Peenamatic unit fires steel shot at the workpiece by compressed air from ten nozzles mounted on a moving carriage. The force of the shot changes the surface contours and hardens the material. The machine operates normally at about 25 lb. per sq. in. although more than twice this amount of pressure is available. After being peened, the surface of the material is so smooth that it can be finished without further milling. Sections can be masked off with rubberised tape where contouring is not desired.

REPEAT FOR KENTS

A NEW order for a further 32,000 water meters, with an option to extend it to 38,400, has recently been placed with George Kent Ltd., Luton, by the Teheran Water Authority, and brings the value of Kent meters already installed or on order by that authority to over £300,000.

B.I.T.A. SPONSOR BRITISH STUDENT

A BRITISH student will this year be sponsored by the British Industrial Truck Association to attend the 1959 Materials Handling Course at Lake Placid, U.S.A. This student will be taking up an award made under the terms of a memorial to B.I.T.A.'s first president, the late John M. Morris, which is valued at over £500.

The memorial will take the form of an annual place at a training establishment for a person who may benefit himself and his industry in the materials handling field. The Council of the British Industrial Truck Association has approached the industry and universities in Great Britain with a view to selecting a suitable candidate. It is hoped that on his return the selected candidate would be able to lecture and report on the theory and practice of efficient handling systems and the latest American practices.

10th PLASTICS LECTURE

By I.C.I. Chief

THE tenth annual lecture of The Plastics Institute will be given on March 12 under the title " International Competition in the Chemical Industry " by S. P. Chambers, C.B., C.I.E. (deputy chairman, Imperial Chemical Industries Ltd.), at the Wellcome Foundation Building, Euston Road, at 6.30 p.m. The lecture will deal with the pattern of world trade in chemicals and will analyse exports and competition, with particular reference to competition from behind the iron curtain.

A one-day conference on " Adhesion " has been arranged by the London Sections of the Plastics Institute and the Institution of the Rubber Industry, on Friday, April 17, in the William Beveridge Hall of the London University, Malet Street, W.C.1. Five papers will be given, covering theoretical and applied aspects of the subject.

Full information can be obtained from the secretaries of either the Institution of the Rubber Industry, 4, Kensington Palace Gardens, W.8 or the Plastics Institute, 6, Mandeville Place, W.1.

CAMBRIDGE INSTRS. NEW LABORATORY

CONSTRUCTION has commenced of the new research laboratory for the Cambridge Instrument Co. Ltd. at Cambridge. The building will comprise four floors and will be fitted with the latest equipment for instrument work involving physics, chemistry, electronics and precision mechanical engineering. The architects are Edward D. Mills and partners (who designed the British Industries Pavilion at the Brussels Universal and International Exhibition 1958) and J. Jarvis & Co. the main contractors. The new laboratory is scheduled for completion in June.

The company's showrooms at 13, Grosvenor Place, London, S.W.1 have also been completely redesigned and refurnished, and instruments are displayed on easily accessible fixtures and showcases.

S. WALES AGENCY FOR DYMAC ENG. CO.

AN agency for South Wales has been granted by Plastic Constructions Ltd., Weatheroak Road, Sparkhill, Birmingham, 11 to The Dymac Engineering Ltd., Dymac Works, Pontardawe, Swansea, Glam.

4-DAY CORROSION EXHBN. IN APRIL

THE Corrosion Exhibition, which will be open for four days, April 27-30, at the Royal Horticultural Society's New Hall, Westminster, will be opened by Sir Owen Wansbrough-Jones, K.B.E., C.B., Ph.D., F.R.I.C., chief scientist of the Ministry of Supply. Sir Owen, who runs one of the biggest scientific organizations in this country, was trained as a physical chemist at Cambridge under Sir Eric Rideal and at Berlin under Fritz Haber. During the war, as a general staff officer, he was working on chemical warfare and a variety of other technical and scientific matters. Among his many interests Sir Owen is treasurer of the Faraday Society, and is a member of the Court of Assistants of the Goldsmiths' Company.

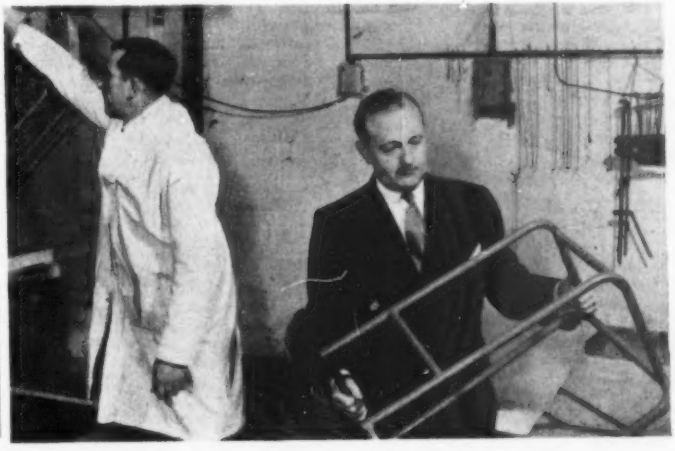
Over 70 firms will be showing at the Corrosion Exhibition, and tickets are available from " Corrosion Technology," Leonard Hill House, Eden Street, London, N.W.1.

"STELVETITE" IN AMBULANCE BODY

THE first vehicle ever to have an interior lining of plastic-coated steel has been produced by a Maidstone, Kent, bodybuilder. The vehicle, a Karrier ambulance, is fitted with a composite wood/light-alloy body, the roof, sides and rear doors being lined with white " Stelvetite," giving an attractive appearance, completely hygienic, easy to clean and simple to manipulate with conventional body building tools. This vehicle is to be operated as a works ambulance by the Rootes Group manufacturing division at Coventry. (*See " Stelvetite " Exhibition*).

PROCESS FOR BONDING PLASTICS TO METAL

PLANT capable of bonding many polythene and other types of plastics to ferrous or non-ferrous metals by the patented " Plasinter " process has recently been installed by the Darlaston Galvanised Holloware Co. Ltd., Holyhead Road, Wednesbury, Staffs. A new division has been created to use the process. In the picture below, Mr. S. J. Hurley, works director of the new company, inspects the finish obtained on a tubular steel stool. The operator in the background is removing a bottle crate from the coating plant. In addition to polythene, plastics such as p.v.c., p.t.f.e., p.t.f.c.e., and nylon can be used to increase the resistance to chemical action and corrosion of many metal parts. Other advantages that can be obtained are good electrical insulation, reduction of noise in handling crates, and easy maintenance. The idea of using plastics as a coating for metals is not new, and contributions have appeared in this journal on the process ; however, judging from a specimen of one of the company's products sent to this office, the " Plasinter " process does appear to be very effective in bonding the covering to the metal base.



TECHNICAL *and* INDUSTRIAL APPOINTMENTS

The board of directors of **Aluminium Ltd.,** Montreal, Canada, have announced the resignation of Mr. Elmer G. MacDowell as chief sales management officer of the company. Although retiring from the post he has occupied for the past 30 years, Mr. MacDowell will continue in the capacity of director and vice-president of Aluminium Ltd.

Mr. Edwin J. Mejia, a director and vice-president of Aluminium Ltd., has been appointed to succeed Mr. MacDowell, and to do this, Mr. Mejia has resigned as chief employee relations officer of the company.

Shortly after the formation of Aluminium Ltd., in 1928, Mr. MacDowell was given overall sales responsibility for the new group of companies, and made his headquarters in London, England, from 1932 to 1939. Upon his return to North America he became a director and a vice-president of the company and subsequently was made a director of many subsidiaries.

Mr. Mejia was made a director and vice-president of the company in 1940, and shortly afterwards was put in charge of employee relations for the Aluminium Ltd. group of companies. During the past four years he has also had responsibilities with interests in French Guinea.

The election of Mr. Fraser W. Bruce to the board of **Aluminium Ltd.** was recently announced. Mr. Bruce is also president of Aluminium Ltd.'s subsidiary, Aluminum Co. of Canada Ltd.

Mr. Melvin P. Weigel has been appointed a director of **Aluminum Co. of Canada Ltd.** ; he is director of operations of Alcan's parent company.

Both of these appointments also follow Mr. Elmer G. MacDowell's retirement.

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The O. Hommel Co., Pittsburgh, 30, Penna., U.S.A., has expanded its West Coast sales staff and has appointed Mr. John C. Welch, Jr., (who is returning to the Hommel organization after an absence of seven years) to the porcelain enamel frit sales staff. Mr. Welch is a member of The American Ceramic Society and Keramos.

Mr. William Barr, O.B.E., honorary treasurer since 1953, has been nominated president of **The Iron and Steel Institute** for the 1959-1960 session. He will take office on May 6.

Born at Larkhall, Lanarkshire, Mr. Barr was educated at Hamilton Academy and the Royal Technical College, Glasgow. He joined David Colville and Sons Ltd. in 1922 as a metallurgist, becoming assistant works metallurgist at Dalzell works in the following year. He became chief metallurgist of Colvilles Ltd. on the formation of the company in 1936. He was appointed a director of the Fullwood Foundry Co. Ltd. in 1945,

WILLIAM BARR, O.B.E.
(Iron and Steel Institute)

and executive director of Colvilles Ltd. two years later ; he became a full director of the company in 1954.

His research activities have been devoted to investigations on creep, brittle fracture of mild steel, and the development of low-alloy high-tensile structural steels and stainless-clad steels. He is a founder, fellow and past-president of The Institution of Metallurgists, and a past-president of the West Scotland Iron and Steel Institute. He joined The Iron and Steel Institute in 1925, becoming a member of council in 1948 and honorary treasurer in 1953.

* * *

The appointment of Mr. Robert E. Sperber as assistant to the president, Mr. Ernest M. Hommel, of **The O. Hommel Co.,** Pittsburgh, U.S.A., was announced recently.

Mr. Sperber has a wide background in sales work in the Cleveland area. He joins Hommel from the Geometric Stamping Co., where he was sales promotion manager. He has also been associated with National Cash Register Co., General Hard Chrome Co., and Hard Chromers, Inc., all in Cleveland.

* * *

It is announced by **Crompton Parkinson Ltd.** that Mr. J. G. P. Anderson, B.Sc., F.Comm.A., A.M.I.E.E., A.M.B.I.M. has been appointed manager of their development and research dept. Mr. Anderson joined the company in 1939 and until his new appointment was manager of the A.S.T.A. short-circuit testing station at Chelmsford.

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Mr. J. A. Hayward who, since 1946, has been a director of many overseas companies in the Firth Cleveland group, has now been appointed to the Board of **Firth Cleveland Ltd.**

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Mr. F. Rath, publicity manager of The Geigy Co. Ltd., Manchester, has returned to Switzerland to take up an appointment with the publicity department of the parent company, **J. R. Geigy S.A., Basle.**

* * *

British Titan Products Co. Ltd. announce the retirement of Mr. B. T. Minter. He joined the company in January, 1934, and was appointed a director in March, 1946.

* * *

Mr. G. K. Hampshire, chairman of I.C.I.'s General Chemicals Division, and Dr. J. S. Gourlay, chairman of the Paints Division, have been appointed to the board of **Imperial Chemical Industries Ltd.** with effect from February 2, 1959.

* * *

Mr. F. L. Gibson, who joined **Wolf Electric Tools Ltd.,** Pioneer Works, Hanger Lane, London, W.5, eight years ago, has been appointed sales manager for the home market. He has been closely associated with the portable electric tool industry for nearly 20 years.

* * *

Commander P. W. Kent, R.N., chairman of **George Kent Ltd.,** Luton, Beds., recently presented a farewell gift to Mr. J. Horridge, works manager since 1951 of **George Kent Ltd.,** who will be retiring early in 1959 on medical grounds. Mr. J. F. Willsher has been appointed general works manager of the company.

MEETINGS OF THE MONTH

February 17

Institution of Mechanical Engineers, (Hydraulics Group), "The Pumping of Liquids of Unusual Viscosity, Volatility, or of Solid or Gas Content," a discussion, at 1, Birdcage Walk, London, S.W.1. 6 p.m.

February 18

Society of Instrument Technology (Newcastle Section). "Variable Area Flowmeters," by F. C. Whalen, in King's College Stephenson Buildings, Newcastle-on-Tyne. 7 p.m.

February 20

Oil and Colour Chemists Association (Midlands Section). "Some Factors Relative to Solvent Evaporation," by E. Chadwick and A. J. Simpson, at Regent House, St. Philip's Place, Birmingham. 6.30 p.m.

February 24

Society of Instrument Technology (Control Section). Symposium on Automatic Weight Control in Industry. "Automatic Production Line Weighing Techniques," by A. L. Hendon and G. C. Chapman. "Batch Blending," by R. N. Settle. "An Electro-Pneumatic Constant Weight Feeder for Ore Blending,' by E. I. Lowe and M. J. Harris "The Use of Local Cells in Industrial Weighing and Controls," by Dr. R. B. Sims and J. Nortcliffe, at Manson House, Portland Place, London, W.1. 6 p.m.

Incorporated Plant Engineers (Glasgow Branch). "Industrial Air Conditioning," by H. Poole, joint meeting with the Heating and Ventilating Engineers, at the Scottish Building Centre, 425/7 Sauchiehall Street, Glasgow. 7.15 p.m.

February 25

Society of Instrument Technology (S. Wales Section). "The Development of Flow Measurement," by B. L. Thurley, in the Physics Lecture Theatre of the Welsh College of Advanced Technology, Cardiff. 6.45 p.m.

VAUXHALL AIRLIFT

WITH one flight daily, Vauxhall Motors recently inaugurated a delivery service for cars to Northern Ireland from the Luton factory. Bristol Freighters carrying either three Victors or two Crestas are being used for the service operated by B.K.S. Air Transport Ltd.

February 26

Institute of Metals (Sheffield Section). Symposium on Corrosion. Three or four short papers by invited speakers followed by a general discussion, in the Engineering Lecture Theatre, The University, St. George's Square, Sheffield. 2 p.m.

Institution of Production Engineers (S.E. Region). "New Techniques in Non-Destructive Testing," by W. G. Cook, at the Sun Hotel, Chatham High Street, Chatham. 7.30 p.m.

Institute of Metal Finishing (Bristol and S.W. Branch). Annual Dinner and Dance, at the Royal Hotel, College Green, Bristol. 7 p.m.

March 3

Institution of Electrical Engineers. (Measurement and Control Section). "The Influence of Consumers Load/Consumption Characteristics on Metering Practice," by L. B. S. Golds, at Savoy Place, London, W.C.2. 5.30 p.m.

March 4

Society of Chemical Industry, (Corrosion Group). "The Diagnosis of the Causes of Corrosion Failures," by J. B. Cotton, R. A. Hine, E. E. White, and K. A. Chandler, at 14, Belgrave Square, London, S.W.1. 6.30 p.m.

March 5

East Midlands Metallurgical Society. "Plastic Coated Steel Sheet," by F. H. Smith and W. E. Martin, at the College of Art, Green Lane, Derby, 7.30 p.m.

Birmingham Paint, Varnish and Lacquer Club. "Paints and Resins from the Continental Standpoint," at the Imperial Hotel, Temple Street, Birmingham. 7.50 p.m.

March 10

Institution of Chemical Engineers (North Western Branch). "Symposium on Fluidisation," day meeting in the Chemical Engineering Building, Manchester College of Science and Technology, Jackson Street, Manchester.

Society of Instrument Technology (Manchester Section). "Electro-Magnetic Flow Meters," by L. M. Bennett, in the Manchester Room, Central Library, St. Peter's Square, Manchester. 6.30 p.m.

March 11

Incorporated Plant Engineers (Edinburgh Branch). Annual General Meeting, followed by "Factory Drainage," by T. W. Prentice, at 25, Charlotte Square, Edinburgh. 7 p.m.

March 16

Institute of Vitreous Enamellers (Scottish Section). "Day-to-Day Operations of the Enamelling Shop," by A. H. Symonds, at the Plough Hotel, Stenhousemuir.

Institute of Vitreous Enamellers (Midland Section). "Architectural Enamels," by T. J. McArthur, at the Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham 2. 7.30 p.m.

March 18

Society of Chemical Industry (Corrosion Group). "Economic Aspects of Corrosion," by A. Keynes, at 14, Belgrave Square, London, S.W.1. 6.30 p.m.

Institute of Vitreous Enamellers (Southern Section). "The Future of Cast Iron for Vitreous Enamelling" by J. Bernstein, at the Howard Hotel, Norfolk Street, London W.C.2. 7.15 p.m.

Institute of Vitreous Enamellers (Southern Section). Annual General Meeting, followed by "The Influence of Chemical Composition of Enamel on its Alkaline Resistance" by A. N. Revell, at the Howard Hotel. Norfolk Street, London, W.C.2. 7.15 p.m.

2nd Dinner Dance For Bristol I.M.F.

THE second annual dinner and dance of the Bristol and South West branch of the Institute of Metal Finishing will be held on February 26 at the Royal Hotel, College Green, Bristol. Tickets at 27/6d. each can be obtained from Mr. R. A. Wilding, 11, Fenton Road, Bristol 7, and since these have been strictly limited, early application is advised. There will be dancing to the music of Arthur Alexander and his ballroom orchestra, and members and guests from other branches will be particularly welcome.

DOMESTIC WARE AT MARCH IDEAL HOMES EXHIBITION

THE *Daily Mail* Ideal Home Exhibition opens at Olympia on March 3 this year.

The decorative scheme of the Grand Hall will be "robustly" English, say the sponsors. As visitors enter the main entrance they will see, dominating the east end of the hall, a structure built in a style modelled on Blenheim Palace, and a stately obelisk towering above a large fountain. The stands on either hand will be built as cottages, their roofs and walls bedecked with flowers and creepers and ornamented with lanterns and signs wrought in iron. Further on, visitors will enter a village street. At the approach of evening, the scene will be flooded with artificial moonlight, and lanterns will illuminate the buildings.

The exhibition will also contain the British Government pavilion from Brussels, containing many of the original displays.

Fourteen acres of the show will house about 500 stands, many showing the latest products and developments in the domestic field, including examples of holloware for the home.

INDUSTRIAL EQUIPMENT IN LONDON SHOP WINDOW

A FEW weeks ago, Aerostyle Ltd., North Acton, London, arranged the attractive window display seen below in the Tottenham Court Road window of John Line and Sons Ltd. Originally intended to occupy window space in this busy Central London thoroughfare for a week, the display attracted such wide attention and so many enquiries that it was carried on for three weeks, a good example of how a well set-out display of industrial goods will attract interest and orders from passers-by.

TECHNICAL BOOKSHELF

Coated Abrasives—Modern Tool of Industry. Compiled by the Coated Abrasives Manufacturers' Institute, published by McGraw Hill Publishing Co., Ltd., McGraw-Hill House 95, Farringdon Street, London, E.C.4. 422 pp. 66s. net.

COATED abrasives, by which are meant flexible sheets bearing a coating of abrasive grains attached by adhesive, have a long and honourable history, the first emery cloth having been invented in 1831 by an Englishman. For many years however, it would certainly not have been accurate to describe coated abrasives as important tools of industry, as their applications were strictly limited to the final smoothing of wooden surfaces and the somewhat haphazard removal of corrosion products from metals.

The emergence of hard, fast-cutting synthetic abrasives and of flexible synthetic adhesives has revolutionised the capabilities of coated abrasives and opened the way for their application for numberless operations in many industries on a wide variety of materials. Many industries have not been slow to take advantage of the improved performance offered by modern coated abrasives as can readily be perceived by a visit to the finishing departments of a motor-car or refrigerator manufacturer. In spite of this however, it is certainly true to say that the full potentialities of coated abrasives as tools in the production chain are still very far from complete realisation.

One of the many virtues of the excellent book under review is that by quoting in no little technical detail the use made of coated abrasives in different industries there is every possibility that a reader may find a suggestion for a use of these versatile materials referred to in a section of the book devoted to some branch of industry remote from his own.

The book contains a wealth of information on the selection and use of coated abrasives and their associated equipment, actual methods for improving abrasive efficiencies, a comprehensive review of specific applications in widely differing industries and concludes with a chapter of brief illustrated case histories, almost all of which well repay study.

Careful reading of what this book has to offer could well throw light on methods of mechanizing some of the finishing processes which, even today, are laborious, time-consuming and expensive.

Hot Dip Galvanizing 1956. London : 1958. Zinc Development Association, 34 Berkeley Square, London, W.1. 244 pp., 108 illustr. 45s. net.

THE authoritative story, revised and edited, of the Milan International Conference, this book is the fourth in the series and follows the pattern set by its three predecessors. It will become a similar work of reference essential to all users of steel.

The subject matter has been arranged under ten chapter headings. The discussions contained in it have been carefully edited, and have been presented in a logical order together with a number of written contributions to bring the book completely up to date. A comprehensive subject index has also been added.

Founded on eleven papers contributed by authors from five countries, and approved by an international selection panel set up by the European General Galvanizers Association, the book will be of interest to all galvanizers, whether specialist or general. The results of two years extensive work study in general galvanizing are summarized, and a survey made of practice in forty-four plants in Europe, and the U.S.A.

IMMERSION HEATERS FOR VATS

Titanium Sheath Makes Development Possible

THE heating of chrome plating vats by an external jacket carrying hot water or steam has always been one of the electro-plating engineer's worst headaches, one reason being that leakage of plating solution is difficult to detect. Control of vat temperature is complicated by the high thermal capacity of the jacket, and the plating vat responds only slowly to changes in input of heat to the jacket.

A much more convenient way of keeping the solution at working temperature is to immerse a steam heating coil in the vat, but conventional materials, including plain, antimonial, or tin-bearing lead, give poor service because of chemical attack often accompanied by mechanical damage. The plating industry has recently been making increasing use of immersion coils made from titanium tubing, available in a variety of diameters and gauges. Titanium, as strong as steel and half the weight, is completely inert to chromic acid hot or cold, and steam coils with a wall thickness of the order of 20 s.w.g. will last indefinitely. Users have reported that vats can be heated with titanium coils in 25 per cent less time than with lead coils of the same size, according to I.C.I. Ltd., makers of the material.

Simple units not requiring welding can be made from titanium tubing by anyone with a little experience in the bending of light-gauge tube, and more complex coils can be obtained from fabricating firms equipped with Argon-arc welding facilities, or as standard items from manufacturers of electro-plating plant.

POLISHING EQUIPMENT MAKERS MOVE SHOP AFTER 100 YEARS

A BIRMINGHAM firm, which has been in Little King Street for more than 100 years, has this month completed its move to the first factory on a new Tyseley industrial estate.

The new 20,000 sq. ft. building for Cooper and Co. (Birmingham) Ltd., industrial felt manufacturers, was opened at Seeleys Road recently. First the machines and production workers were transferred from Little King Street. A fortnight later the offices were moved.

The transfer is the second stage of the company's re-development forced upon it by Birmingham Corporation clearance plans. The Little King Street site is eventually to form part of the new Lucas "factory-in-a-garden" scheme for the area.

Eight years ago, the Cooper company made its first change by opening a new factory at Brynmawr, Breconshire—and this has now become the main production centre. The company's production includes felt bobbing and polishing equipment and oil retainers.

Griffin & George Chief on Far East Sales Tour

THE chairman of the Griffin & George Group of Companies, Mr. K. G. Sinclair, is at present undertaking a 2-month tour of India, Australia and New Zealand. On this trip Mr. Sinclair will have with him the first copy of the company's new 350 page catalogue of laboratory apparatus recently published, and will be calling in the main cities of the countries mentioned.

CHANGE OF ADDRESS

THE address of the technical sales department of Oxy-Catalyst Sales Ltd., has been changed from 123, Victoria Street, London, S.W.1, to Rayleigh House, High Street, Great Bookham, Surrey.

T.R.I. HARD PLATING NOW BEING USED IN WATCH TRADE

LEADING watchmakers have discovered that tin-nickel plating, developed in the laboratories of the Tin Research Institute, Greenford, protects watches against corrosion and wear. The ordinary watch has between 50 and 100 parts, and some of the screws used are smaller than the smallest pinhead. All these parts are subject to wear and corrosion, and tin-nickel plating prevents corrosion and finger-marking throughout the life of the watch it is claimed. The Institute says the coating is as hard as chromium, and on watch parts tin-nickel coatings as thin as three hundred-thousandths of an inch provide protection for the smallest screws. This form of coating is not expensive, and is being increasingly used for such products as precision drawing instruments, microscopes and telescopes, according to the Institute.

NEW COMPANIES

"Ltd" is understood, also "Private Co."

Figures = Capital, Names = Directors, all unless otherwise indicated.

Marine Anti-Corrosion, 120, Bishopsgate, E.C.2. December 12. £1,000. Capt. Sidney R. Bew, Walter W. Brown, Sydney Hutton.

General Industrial Enamellers, 209, Torrington Avenue, Tile Hill, Coventry. December 17. £2,000. Frank W. Jolley, Vera C. Jolley.

Croydon Tool and Case Hardening Specialists (1958), Union Road, West Croydon, Surrey. December 22. £10,000. David M. Morgan, John W. Martin, Mrs. Eunice Morgan and Mrs. Joan M. Martin.

Abbey Metal Finishing, Weddington Road, Nuneaton, December 23. £6,000. Jack Cope, Arthur S. Toone.

Electromark (G.B.), 292 Worton Road, Isleworth, Middx. December 31. £10,000. To carry on bus. of manufacturers of and dealers in equipment and materials for marking and surface treatment of metal and other substances, etc. Thomas C. W. Roe, Ian M. E. Aitken, Clifford Garnett.

Goldcraft, 10, Hatton Place, London, E.C.1. January 6 £1,000. To carry on bus. of manufacturers, designers, repairers, tool, gauge, jig, pattern and die makers, engravers, gilders, platers, etc. Gideon Young, Maurice Rebak.

Dudley Galvanising and Holloware, Brickkiln Street, Harts Hill, Dudley. January 7. £1,000. Leonard Stevens, John Stevens.

Liverpool Metal Finishers, 7, Moorfields, Liverpool. January 8. £100. Wm. H. Thompson, George S. Horton.

From the Register compiled by Jordan & Sons Ltd, 16 Chancery Lane, London, W.C.2.

New Regulations For N.I. Awards

APPEAL against decisions made by medical boards as to whether a person is suffering from an industrial disease can now be made, under new regulations recently introduced by Mr. John Boyd Carpenter, Minister of Pensions and National Insurance, that took effect from January 5 last. Appeals will be decided by medical tribunals consisting of doctors of consultant status sitting with a legal chairman. Previously, the tribunals have been able to consider appeals against the assessment of the *extent* of disablement due to an industrial accident or disease. Full details of the new regulations can be obtained from H.M.S.O. price 3d.

SURFORM IN NORWAY

A VISIT to Norway has recently been made by Mr. P. Pehrson, executive director, export sales, of Simmonds Aerocessories Ltd. and Firth Cleveland Instruments Ltd., and Mr. R. Goodburn, export sales manager for Surform hand tools.

TRADE and TECHNICAL PUBLICATIONS

" Lechler Spray Nozzles " is a summary of the principal types made for atomizing liquids over a wide range of applications by Ascog Ltd., Ascog House, 44 Theobalds Road, London, W.C.1. Detailed specifications covering capacities and dimensions of each type are set out in separate leaflets, available on request. The sprayers are made in many alloys and compositions of metals, and are suitable for use in chemical plants.

* * *

" Trisec " is a booklet recently issued by Imperial Chemical Industries Ltd., I.C. House, Millbank, London, S.W.1, to give information about the additive to trichloroethylene of that name for the rapid drying of metal articles. The patented process makes use of the low heating requirement of a boiling chlorinated solvent such as trichloroethylene to give a completely stain-free finish on polished metal in degreasing. The booklet describes and illustrates the applications of the process, the method of operation, and plant details : it can be obtained free on request.

* * *

Technical Publication No. S/109 has recently been issued by Wallace and Tiernan Ltd., Power Road, London, W.4, to describe the activities of the company in various fields of precision control in chemical feeding, and includes brief notes with illustrations of the products manufactured. A list is given of technical literature carrying comprehensive information about the machines illustrated. A second list is a bibliography of reprinted articles on various processes also available on request from the company. Of particular interest to metal finishers are " Treatment of Cyanide and Chromium Wastes," " The Disposal of Waste Material in the Electro-plating Industry," and " Effluent Disposal."

* * *

Among the articles carried in a recent issue of " The Bonderizer " published by The Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford, Mddx., is one describing an interesting application of the " Parco-Lubrite " process for preventing corrosion on parts of remote handling equipment used by the Atomic Energy Research Establishment at Harwell. The equipment, used in this instance for making metallurgical examination of radioactive specimens, was exposed to evaporation from large quantities of water, acetone, carbon-tetrachloride and paraffin stored in open vessels. The corrosion occurred at the mechanical joint between the " hand " and " arm " of the remote handling equipment. The solution was found to be treatment with the Parco-Lubrite process followed by a molybdenum disulphide finishing treatment, to obtain a rust inhibitor and lubricant retainer. The process is normally used for the treatment of ferrous moving parts to prevent galling, pick-up, local welding and other troubles associated with the running-in of moving parts.

* * *

" Ultrasonic News " is the name of a new house journal published by Branson Instruments Inc. and the Branson Ultrasonic Corpn. It made its debut from Stamford, Conn., U.S.A. at the end of last year, to give news of the companies' products, industrial techniques and applications of " inaudible sound." The companies claim twelve years' experience in the use of high frequency sound for gauging, cleaning and testing ; they invite questions on the subject and offer technical assistance. The first issue describes how the Sperry Rand Corpn. is using the equipment at several stages in manufacturing silicon diodes ; the stages are explained and illustrated.

NEW OFFICES FOR LONDON PAINT SUPPLIERS

SEEN below are the new offices of Robert Ingham Clark and Co. and R. Gay and Co. occupying three floors of the Pullin building at 93-97 New Cavendish Street, London, W. 1. The telephone number is now Langham 0831 and the telegraphic address is Pearline, Wesphone, London.

John Summers' Plastic Coated Steel Sheet

Makes a Debut at the Royal Festival Hall

"STELVETITE" EXHIBITION

AN exhibition devoted to the applications, fabrication and jointing of Stelvetite, the plastic-coated steel sheet manufactured by John Summers and Sons Ltd., Shotton, Chester, was held at the Royal Festival Hall from January 13 to 16. Many new manufacturing techniques have been originated to take full advantage of the material, and in addition to showing current and suggested future applications, the exhibition included demonstrations of many of the methods adopted for forming and jointing.

A large part of the exhibition was devoted to showing uses of the material, and typical examples included tanks for plating plants (Electrochemical Engineering Co., Ltd.), fume ducting (Ductwork Ltd.), drums (Rheem Lysaght Ltd)., and drum ends (Reads Ltd.), all making use of the plastic surface of Stelvetite for interior faces. A fabricated water tank (George Birch and Co. Ltd.), and a deep-drawn sink unit were other examples.

Examples of the use of the material for its decorative and protective properties, that is with the plastic on the exterior surface, included building panels (Stewart and Gray Ltd.), lift doors (Potter Rax Ltd.), instrument panels (B.X. Plastics Ltd.), office partitioning (Crittall Mfg. Co. Ltd.), a photoprinting machine (Copycat Ltd.), a cupboard unit, illustrated in Fig. 2 (Jenkins Fidgeon Ltd.), a note counting machine (Vacuumatic Ltd.), a domestic water heater (Santon Ltd.), instrument cases (Dawe Instruments Ltd.), a frozen food cabinet (Aerophreze), clock cases (Smiths English Clocks Ltd.), an electric-motor cover and acoustic panels (N. Greening and Co. Ltd.), a car radio (Pye Ltd.), a domestic portable television receiver cabinet (Plessey Ltd.), a folding picnic table (Scottish Mechanical Industries Ltd.), folding tables and stacking chairs (D. Sebel and Co. Ltd.), padded foam panels on Stelvetite (Nelson and Robbins Ltd.), perforated Stelvetite (G. A. Harvey and Co. Ltd.), and the material in expanded form (Expanded Metal Co. Ltd.).

The individual stands at the exhibition were, in the main devoted to forming and jointing, but Grades Metals Ltd. showed their service which provides the Stelvetite sheet cut to exact sizes and shapes. The company have been working in close co-operation with John Summers since the early days to provide this service; they have developed a technique of cutting the material to an extremely accurate degree, and are able to supply panels of any shape and size from stock. The company have also developed a fabricated panel fixed by a concealed method; the exhibit included samples of these made-up panels. Another interesting feature of Stelvetite is its use by the "Do it Yourself" enthusiast who can obtain his supplies cut to size and shape. Demonstrations showed how Stelvetite can be worked and fixed by the keen amateur at home, and practical demonstrations were given with the aid of a guillotine, drilling machine and other tools.

A plastic filler in paste form provides one method of jointing. One such filler is Stelmax, and three types were on show at the exhibition, available in drums or squeezable tubes. The S50 grade, produced in the full range of Stelvetite colours, is used for filling gaps and holes and as a general adhesive. The S14 type creates little attack on the vinyl/metal bond and has good adhesion to all vinyls. The third type, S16, has been developed for use with the hot bond process.

The Electrochemical Engineering Co. Ltd. demonstrated the prototype of a special gun for applying the paste to joints on the inside of typical tanks they are manufacturing for plating plants. These tanks are mainly used for holding rinse waters.

The Armstrong Cork Co. Ltd. showed examples of bonding Stelvetite to wall surfaces and to a variety of other materials. Three adhesives are manufactured by this company. Type H602 is an ivory coloured mastic, specifically formulated for wall surfaces. It is water-resistant, has an open time of up to four hours and is unaffected by temperatures within a range of 30 to 140°F. Large thin-gauge Stelvetite panels were shown attached to specimen wall materials with this adhesive.

Type S701 is a cream coloured adhesive with a synthetic rubber base; its use is with foamed plastic materials. Type W419 is a tan-

Fig.1.—A general view of the exhibition held last month by John Summers in London's Festival Hall to demonstrate the uses of Stelvetite.

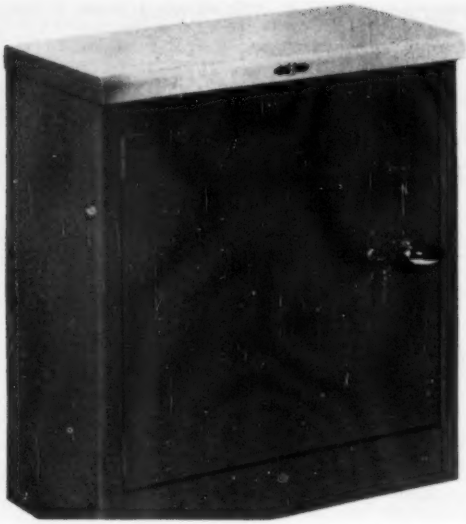


Fig. 2.—(Above)—A range of air-drying matching finishes for the steel surface of Stelvetite was displayed by Robert Ingham Clark and Co. (Right)—Stelvetite is used in the manufacture of this cupboard (Jenkins Fidgeon).

coloured adhesive with exceptional heat resistant properties in addition to the advantages of a contact type adhesive. This adhesive will withstand temperatures of over 212°F., and is water and oil resistant. The type 419 was shown in use for bonding Stelvetite to Stelvetite, Stelvetite to plywood, Stelvetite to Asbestolux, Stelvetite to fibre board, Stelvetite to resinated paper honeycomb and Stelvetite to cork board, The type S701 was shown for use in bonding Stelvetite to foamed polystyrene.

A range of air-drying "Britannia" finishes in matching colours for the steel surface of Stelvetite was shown by Robert Ingham Clark (Fig. 2). These materials included primers, lacquers, polychromatic and hammer finishes.

Cellon Ltd. showed their range of "Cerric" acrylic colours for painting or decorating the plastic surface of Stelvetite. Eight colours plus black and white are available, and they can be applied by brush or spray. A range of acrylic inks for screen printing is also available.

Norman Hay Ltd. demonstrated that Stelvetite can be electroplated on the steel surface after fabrication. Examples were shown of chromium, hard chromium, copper, cadmium, nickel and tin plated components and flat sheets.

A further method of joining the material is by flexible p.v.c. extruded sections. Suitable extrusions can also be used for edging. A wide range of this type of extrusion is available and was shown by C. and C. Marshall Ltd. and Creators Ltd.

G. Johnson Bros. Ltd. exhibited Stelvetite for wall panelling. The panels, each 7 ft. by 3 ft., were constructed from 26-gauge Stelvetite in red, and backed with 2-in. blockboard, which in turn was backed by 23-gauge zinc coated steel to form a compensator. Several of the panels were arranged to form a corner of the stand, and were trimmed with aluminium extruded sections anodized in gold. The vertical connecting sections and the capping mould were of robust design, manufactured from HE.9WP material. The base material comprised a rolled aluminium section and formed not only a seating for the panelling 4-in. above floor level, but was coved internally to form a skirting and carpet trim. This very effective design enhanced the appearance of the panel, and at the same time enabled the carpet to be cleaned to the extreme edge without damaging the skirting connection. The panelling, known as the "Johnson Architectural Stelvetite" panel, can be supplied in sizes 6ft. by 3ft. and 7ft. by 3ft. with special sizes on application. Another interesting exhibit by this company was a vertical fluted section in Stelvetite designed for architraves, doorframes, etc.

Fig. 3—An interior view of the Karrier ambulance with bodywork by Rootes Ltd., of Maidstone, showing the white Stelvetite lining. The seats on the right swing over to provide a stretcher base, and a cot type stretcher is carried on the left.

Latest Developments in PLANT, PROCESSES AND EQUIPMENT

Plating Worktable

A UTILITY table recently introduced by Dalic Metachemical Ltd., 121, Judge Road, Toronto 18, Ontario, Canada, makes it easy for plants and machine shops to set up their own "selective plating" departments in a very limited space. The 3 ft. high table holds the necessary selective plating equipment and materials for depositing almost any metal on any other, the makers say. (Fig. 1.)

Because only small amounts of electrolyte are required, 1-litre bottles containing metallo-organic complexes of many different metals can be kept on hand. These plating solutions, styluses, and other accessories can be stored in the table's drawers and cabinets. Its 3 ft. x 9 ft. countertop, and the 30 in. x 21 in. x 7 in. deep sink have a protective covering of P.V.C. and there are foot controls for both hot and cold water. Also included are needle valves to supply water to circulation-cooled styluses, and a connection for a drying air line.

A Dalic rectifier, with half-cycle cut-off to prevent arcing, supplies the low-voltage D.C. needed for selective plating. The cathode lead is clamped to the work-piece, and the anode lead is then fitted with a cotton-wrapped stylus. After dipping in the appropriate electrolyte, the stylus is lightly rubbed over the surface to be plated.

The table is designed to accommodate a low-speed turning head for holding small, symmetrical objects such as bearings. The turning head allows the part to rotate while the plating stylus is rubbed against it to obtain a uniform deposit. Metachemical Processes Ltd., 41-43, Gatwick Road, Crawley, operate the Dalic processes in the U.K. The selective plating technique for fluxless soldering recently introduced by Dalic was described in the "News" section of the November issue of the Journal.

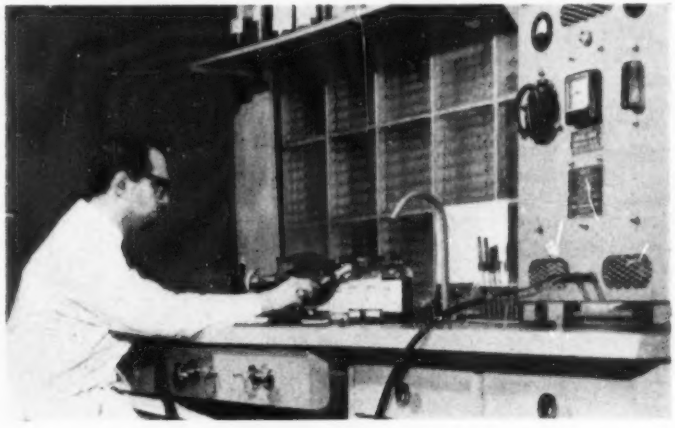


Fig. 1.—A compact worktable accommodates a wide variety of materials and ancillary plant for "selective plating."

Mercury Lamp and an Improved Anode

THE Baker Platinum Division of Engelhard Industries Ltd. held a private exhibition at the Midlands Electricity Board Industrial Showroom in Birmingham recently when a number of the company's products were on view to industry.

Among the exhibits were a prototype 2-kW mercury vapour fluorescence suspension lamp for use in quality control systems, and a fine-silver "dogbone" shaped anode that the makers claim has the ability to retain a high proportion of its surface area in comparison with a conventionally shaped anode.

The lamp was developed to provide non-destructive testing for large components in the engineering industry by using fluorescent ink methods, and is intended to supplement an already well-known smaller model being marketed by the company.

A rectangular metal case housing a 2 kW mercury vapour lamp can be suspended over an inspection bench. Cooling is provided by a top-mounted fan, and warm air is exhausted through ducts at each end of the case. Six ultra-violet filter glasses are fitted to the underside of the lamp transmitting about 75 per cent of the middle u.v. wavelengths. With the lamp 5 ft. from the area to be used. distinctive fluorescence is obtained along 11 ft. of the central main axis of the lamp, and with the high fluorescence yield from the testing fluids now available, surface faults on treated components can be easily marked by the observer. The 2-kW arc tube is standard and can be quickly

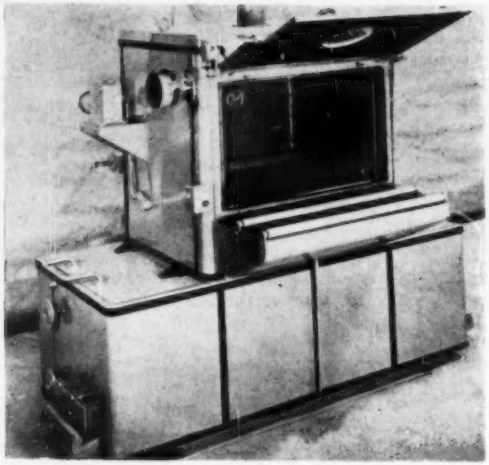


Fig. 2.— This German washing machine can handle in a single chamber the several stages required for some metal pretreatments.

replaced. Made from "Vycor," a glass closely resembling clear quartz, the shorter wavelengths of u.v. radiation that can cause the formation of undesirable noxious gases in the cooling air are absorbed, so that the tube can be used with safety even in closely confined areas.

The company say that in extensive production tests with both the dogbone anodes and conventional sheet anodes, when these have been operated under similar conditions, until only 15 per cent of their original weight remains, the loss of surface area is approximately three times greater for the conventional sheet anode than for the dogbone anode. They say this is because the dogbone shaped section of the anode ensures uniform dissolution throughout its life. Uniformity of the purity and grain size of the silver in the anode is ensured by routine analysis and testing.

Metal Washing Machine

WHAT is claimed to be an entirely new type of metal washing machine was introduced recently by I.F.A. Engineering Co., Ltd., 13/17 Rathbone Street, London, W.1., who are agents for it in the United Kingdom. The machine, illustrated in Fig. 2, is manufactured by Wilhelm Wache, G.m.b.H. of Hamburg, Germany. Using the spray method, it is suitable for pickling, degreasing and phosphating of all metal components, and it is able to perform these tasks in a single chamber instead of the usual two or three found in conventional plant of this type. There is a considerable saving of floor space, and the machine is economical even on small production, the makers claim.

In use, the door of the machine is closed manually after the basket containing the workpieces has been inserted. Closing the door automatically starts a stop clock and a pre-set working cycle : the degreasing or treatment pump and rocking gear for oscillating the basket are switched on ; at the end of a set time the pump is switched off and a tipping plate moves to return the liquid to its specific tank ; this is followed by the starting of the next pump, when the operation is repeated twice more. On completion of these operations, a signal light informs the operator. Thermometers reading 0-120°C are used to check and control the temperatures of both the treatment solution and the hot water for the rinse.

The machine can be supplied for heating by steam, hot water, electricity or gas, and is fully enclosed. Three sizes are available with tank capacities of 132, 165 and 185 gall.

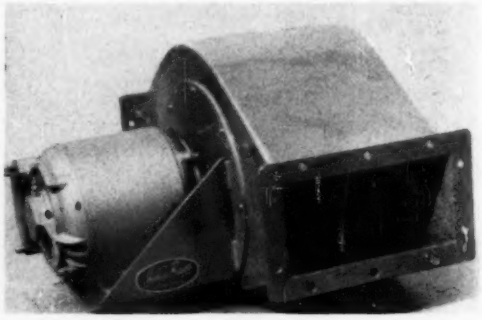
P.V.C. Fans

An example from the range of 'Bassaire' fume exhaust fans is illustrated in Fig. 3. The fans use a patented principle claimed to give centrifugal performance with axial flow. The casing design incorporates this 'CoPlanar' airflow from inlet to outlet. The impeller is constructed for maximum rigidity from p.v.c. A centre-boss in this material has a substantial steel hub and "taperlock" bush. The motor is flanged-mounted to a support plate attached to the fan casing with p.v.c. bolts, to permit the motor and impeller to be withdrawn as one unit, leaving the casing undisturbed in, say, a pipework system.

Within the fan casing all metal surfaces are protected from the air stream. Where fume concentrations are slight the fans can be supplied in steel, lined internally with a stoved p.v.c. finish.

The smallest size in the range is designed for incorporating directly into the construction of any standard 2 ft. 6 in. or 3 ft. fume cupboard. Other sizes and speeds, including belt driven

Fig. 3.— The makers of this fume exhaust fan use a patented principle to create airflow.



models, are available for fume extraction installations and plating tank systems up to 3,000 c.f.m. Prototypes can be developed and supplied to order. Makers are John Bass Ltd., 36, The Broadway, Crawley, Sussex.

P.V.C. Valves and Plating Baskets

A RANGE of screw down p.v.c. valves from ½-in. to 6-in. bore is now available from Turner and Brown Ltd., Davenport Works, Bolton. Called " Turbro " valves, conventional metal bonnet assemblies incorporating Neoprene, Hypalon or nitrile rubber diaphragms are employed (Fig. 4).

The valve bodies are manufactured from " Cobex " p.v.c. and can be supplied with either standard or non-standard flanges, complete with mild steel backing rings. The valves are chemically inert up to 70°C, and a unique feature of the design is the compression-type p.v.c. flange and loose backing ring enabling the valve to be set at any angle with the minimum of inconvenience.

A range of plating baskets manufactured from perforated high impact p.v.c. sheet is also being made by the firm, in various sizes to suit customers' requirements. The perforations have been designed to give maximum free access, resulting in speedy flooding of the basket. Where very small components are used a detachable perforated liner can be supplied to retain the parts in process.

Alkaline Tin-plating Developments

As the result of negotiations with the Metal and Thermit Corp. of New York, Albright and Wilson (Mfg.) Ltd. 1, Knightsbridge Green, London, S.W.1. have announced that they will be the main suppliers of potassium stannate for both immersion plating and electro-tinning in the United Kingdom.

The best known application in immersion plating is in the tinning of aluminium pistons. By using potassium stannate instead of, as at present, sodium stannate, it will be possible to achieve substantial reductions of sludge formation together with much improved analytical control limits, the company says.

Fig. 5.— A hot-rinse tank in a London works lagged with ' Marinite.'

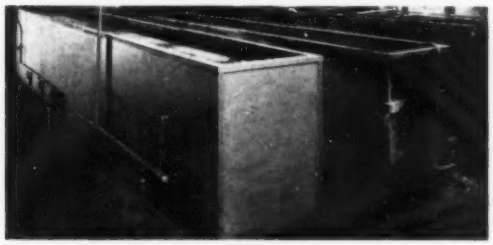


Fig. 4.— Screw-down P.V.C. valves.

It is claimed that in electroplating, solutions containing potassium stannate will have a far greater electrical conductivity than a similar solution containing the same concentration of sodium stannate, so that higher current densities can be obtained for a given voltage, and conditions will be ideal for barrel plating.

Albright and Wilson are also in a position to supply the Metal and Thermit ' High Speed ' tin anodes. One of the main difficulties associated with alkaline electro-tinning is in maintaining the surface of the tin anode in the correct condition, a common source of this type of trouble being the lack of room in the electrolyte for sufficient surface area of the anode to keep the bath in balance. By using ' High Speed ' tin anodes, it is claimed that platers will be able to reduce considerably the conventional area ratio of anode to cathode, and will find it much easier to get the necessary film on the anode. An added advantage claimed is that the preliminary high voltage needed to form the film on a normal anode can be dispensed with when using ' High Speed ' tin anodes.

Data sheets on potassium stannate are available and can be obtained from the Metal Finishing Department of Albright and Wilson (Mfg.) Ltd. Metals and Methods Ltd. of Langley, Slough, Bucks, have been appointed sole distributors in the United Kingdom for ' High Speed ' tin anodes by Albright and Wilson Ltd. The use of potassium stannate and ' High Speed ' tin anodes are covered by British patents, and purchase of these materials from Albright and Wilson (Mfg.) Ltd. conveys a free licence to operate under these.

Lagging for Tanks

ILLUSTRATED in Fig. 5 is a " Marinite "-lagged hot-rinse tank in the Kentish Town, London works of Robert Stuart Ltd., where it is

(*Continued in page* 84).

Plant, Processes, etc.

(*Continued from page* 83).

claimed that use of the material in 1-in. thick 36 density panels has resulted in a 45 per cent reduction in gas consumption.

Marinite is a strong, rigid asbestos board normally used for building industrial ovens, but now being increasingly used for the lagging of plating tanks.

Supplied in large-sized boards up to 10-ft. x 4-ft. the material is erected around the tank, using angle iron for jointing the corners.

With gas underfired tanks, an air-gap of about 2-in. is left between the walls of the tank and the Marinite, which is unharmed by the flame playing on it. With immersion-heated tanks, the Marinite is laid flush against the tank. In both cases the lip of the tank usually projects over the lagging. The material is light in weight, can be easily sawn with a carpenter's saw, will hold screws like wood and is resistant to most plating solutions. The makers recommend a coating of aluminium paint after erection to prevent saturation with spillages that could result in a loss of thermal efficiency. Makers are Marinite Ltd., 104 Park Street, London, W.1.

Grease Stick for Abrasive Belts

THE Schaffner Mfg. Co., Schaffner Centre, Pittsburgh 2, Pa., have announced the development and production of a new grease stick for use in the metal finishing industry.

The stick, G.S.-7205, is a combination of light-bodied greases that the makers say will spread easily on the abrasive belt or wheel, prevent logging or clogging, and prolong working life. They particularly recommend it for slow moving belts or wheels, where there is insufficient speed to melt the more commonly used greases.

Classified Advertisements

Prepaid rates: FIFTEEN WORDS for 7s 6d. (minimum charge) and 4d. per word thereafter, or 24s. per inch. Box number 2s. 6d., including postage of replies.

SITUATION VACANT

VITREOUS ENAMELLING. An excellent opportunity has arisen for a young technician to join an established company in Kenya as Manager of their vitreous enamelling works. Applicants should be capable of supervising all operations. Experience in holloware production will be an advantage. Full details of experience to Box 210 METAL FINISHING JOURNAL.

BUSINESS FOR SALE

ELECTRO-PLATING and POLISHING BUSINESS for sale, Islington District, three double motorised spindles and all necessary equipment for chrome, nickel, copper, silver etc. Premises will be let at reasonable rent. Write c/o 18 Hill Avenue, Amersham, Bucks.

PLANT WANTED

EXHAUST EQUIPMENT for extracting fumes from aquafortis dipping tank. Single lip ducting or hood approximately 4' 6" wide. Complete with trunking and motorised exhaust fan. Detailed offers to Fisco Ltd., 602, Seven Sisters Road, London, N.15.

PLANT FOR SALE

DRYING ROOM — Air Circulated & Gas Fired by Controlled Heat & Air Ltd. 40 ft. x 12 ft. x 7 ft. high, operating up to 300 F. — the purchaser to dismantle and cart. Inspection and offers cordially invited by contacting D.V.E.C., John Penn Street, S.E.13. TID 2201/6.

EQUIPMENT FOR SALE

PLATING AND ANODISING M.G. SETS

250 amp., 5 volt G.E.C.
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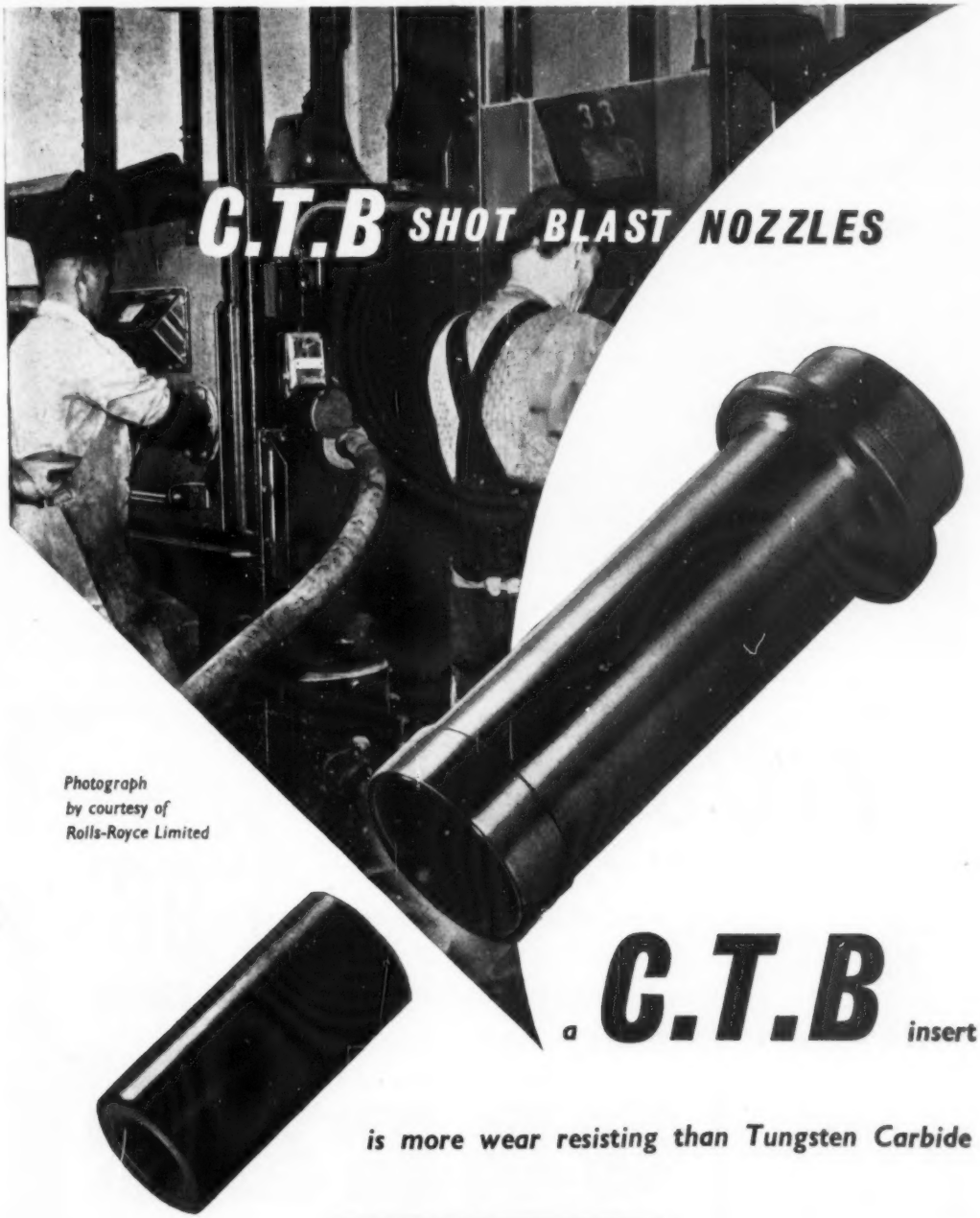

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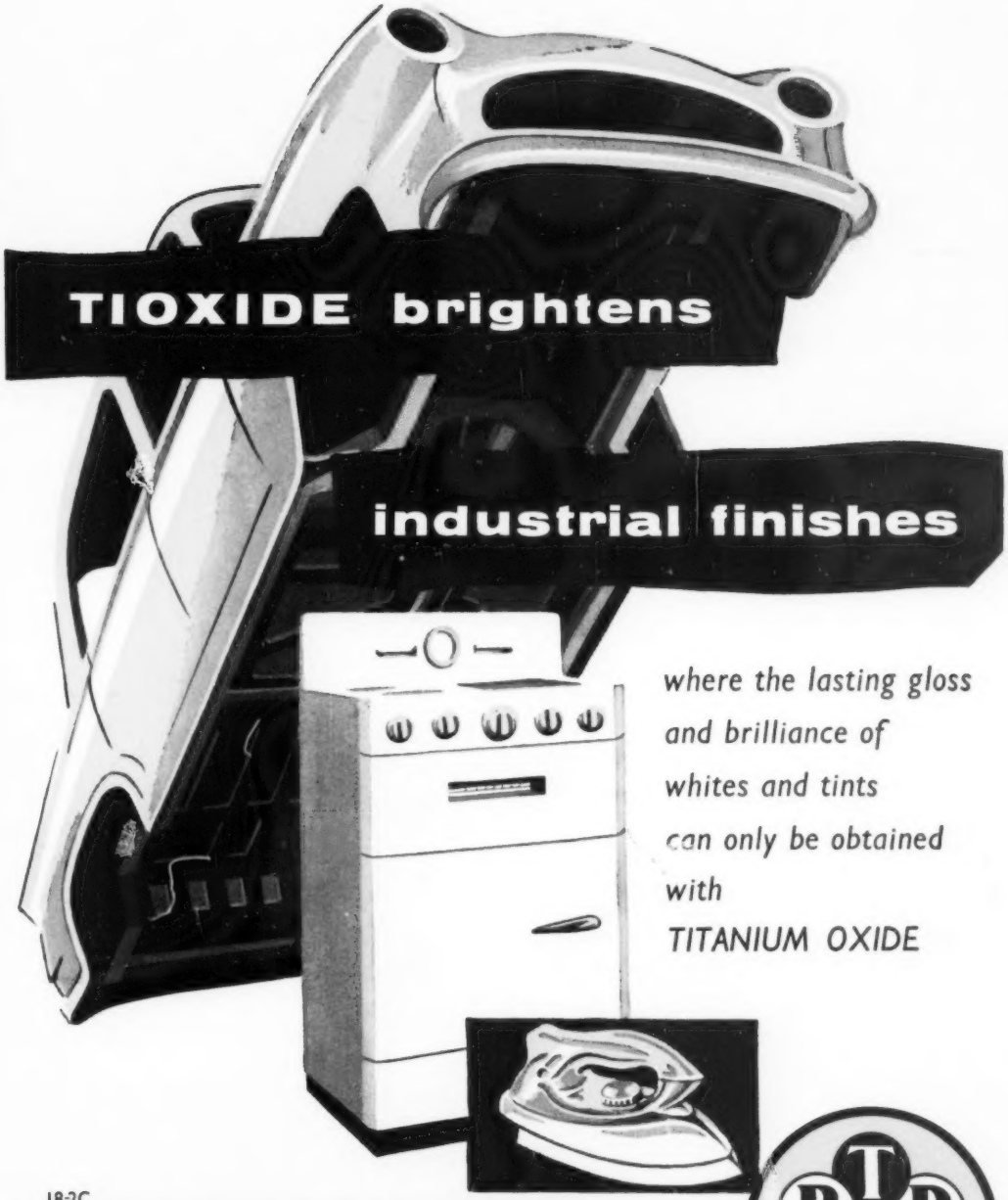

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